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THE STAR STORY OF THE FLOOD.

I HAVE made what appears to me an interesting discovery. In drawing the star-maps, which appear in KNOWLEDGE for March and April, I have lighted on peculiarities which have a singular bearing on an ancient record of a universal deluge long regarded as full of difficulties. A series of coincidences which are very strange indeed if they are merely accidental, points, apparently, in the clearest way to an interpretation which is not indeed absolutely new (were it so I might find the evidence less striking), but for which certainly there has hitherto been no such evidence as that which I am about to suggest.

I have had occasion of late, in dealing with the opening chapters of a book on Astronomy (now nearly a quarter of a century in preparation), to consider the aspect of the stellar heavens as seen by Babylonian and Egyptian astronomers. So far as I know, no modern student of astronomy has been at the pains to picture the starry skies as they appeared at particular long-past epochs in the history of astronomy. Here and there cases have occurred where some special star or constellation has been set back (as it were) so many thousands of years, in order to ascertain what position it had in the days of Ptolemy or Hipparchus, or, farther back still, in the time—some 2200 years B.C.—to which the building of the Pyramids of Egypt was first assigned by those who regard the descending passage as a polar pointer, or yet further back to that time—about 3400 years B.C.—when the same star was in view down that descending passage, and when, according to Egyptologists, the dynasty of the Pyramid builders held sway over the land of Egypt. I have myself, accepting that remoter date as unquestionably the true era of Cheops, Chephren, and the rest of the Pyramid builders, noticed many details of interest in the stellar skies of those days. I find, for example, that the ascending passage and the great gallery within the Pyramid, besides commanding (by reflection at a water surface) the pole-star of the period, bore directly on the star Alpha Centauri, remarkable as the nearest of all our sun's fellows in the star depths. The long trenches dug outside the eastern edge of the Pyramid's base (and called by Professor Smyth the azimuth trenches) bore on the bright stars Arcturus and Capella at their rising, and were doubtless associated with the observation of the rising of these stars, so as to be visible just before sunrise—a relation called the heliacal rising of these first-magnitude stars. The Pleiades were at that time exactly on the equator, a much more critical and interesting feature than Professor Smyth had looked for when he sought a date near the year 2200 B.C., and selected one which put the Pleiades on the meridian passing through the sun's place at the spring equinox—for the equator is of all the circles on the celestial sphere the most easily recognised and the most obviously interesting.

But while I had noticed many such points as these, and had indeed been much attracted by their study, I had not been able to find time for what I had long intended—the construction of maps which should show the whole of the starry heavens as they would have appeared at or about that critical time when the astronomy of the ancient Babylonians and Egyptians (as distinguished from the modern Nebuchadnezzars, Pharaohs, and the rest) reached its culmination. No astronomer who studies carefully what is known about ancient astronomy, can fail to recognise in the astronomy of the later Chaldeans the signs of decadence and degeneration. Nor can we wonder that it is so. Clearly in the days of the earlier kingdoms of Babylon and Egypt, astronomy had been regarded as full of material promise. All the ancient astronomers were astrologers; it was the astrological aspect of astronomy alone which had invited them to the laborious and expensive works by which they had hoped to force from the skies the secret of the stars, and to give to their ruling dynasties the power not only of reading but of ruling the celestial orbs. That hope had been in great measure disappointed. Astronomers still from time to time renewed their aspirations, and we find records that kings and rulers put trust in the promises of their astrological magi and diviners; but never again did whole nations contribute as they had done in the days of Cheops and Chephren, and in those of the builders of the Babylonian temple of the planetary spheres, to erect temple-observatories for the study of the movements of the heavenly bodies. The building of the Great Pyramid and (contemporaneously with it) its fellows in the Ghizeh plains, marked the time when astrological astronomy reached its highest phase of development. It was at once the science and the religion of the great Eastern nations of those days. Cities were built to the sun and moon. All the works of human life, from the day when the babe's nativity was cast to the time when the body was to be committed to the tomb, were regulated by the movements of the heavenly bodies, whose influences as deities were supposed potent over all transactions from the most trivial to the most important.

When leisure, or rather the course of my literary labours, gave me the opportunity to construct a planisphere of the ancient skies, I took for my epoch 3400 years B.C., because while that accorded well with the date assigned by Egyptologists to the reign of Cheops, it brought the pole-star, Alpha Draconis, or Thuban, into the direction aimed at by the long descending passage, cut (some four feet square) into the solid rock below the Pyramid, and continued right through the massive stonework to a total distance of more than a hundred yards. It has always seemed to me preposterous to question the astronomical significance of this polar pointer. One might as reasonably question the astronomical use of the monster sundials and other shadow-throwing structures in Delhi, Benares, &c.—as, indeed, non-astronomical persons would most certainly do if we did not chance to have records of the objects with which these masses of stonework were set up, and of the astronomical uses to which they were applied. The men of the Pyramid times may not have made such advances in science as the men of our own day, but they were not wanting in sense. We may be sure they did not make these obviously astronomical passages and galleries merely to symbolise imperfectly for after ages such knowledge as they possessed, but with a very definite purpose. We may confidently accept as obvious the theory, first advanced by Sir John Herschel, that that long passage was a polar pointer, the longest and most massively constructed ever made by man. We can have no doubt that Thuban, the mid star of the Dragon, was the pole-star towards which it

XUM

was directed. This leaves us only two dates between which to choose, for the time of the important astronomical era marked by the building of the Great Pyramid—viz. about 2200 B.C., and about 3400 B.C.—unless we care to go back some 27,600 years farther, when again we find a pair of dates, about 31,000 and 32,200 years B.C., when Thuban was rightly situated. We may safely reject all such exceedingly remote dates, however, as Egyptologists agree in assigning to the dynasty of Cheops, Chephren, &c., dates between 3200 and 3600 before Christ.

For the date 3400 B.C., then, I constructed my charts, expecting to obtain interesting and curious results. I hoped in particular to find explanations of references to the stars by poets of later days, who recalled old sayings in ignorance of the fact that the aspect of the heavens had altered since those sayings had been in vogue. For experience shows that there are few subjects in which old ideas retain their influence more tenaciously than they do in regard to the aspects and movements of the heavenly bodies.

The first glance at my maps (when they were completed in such sort that the skies of 5300 years ago were presented before me) served to explain several familiar passages of the classics. For instance, Virgil's well-known lines,

> Candidus auratis aperit quum cornibus annum
> Taurus,

imply as distinctly as possible the idea that the year began (which would mean that the sun crossed the equator at spring) when the sun was on the Bull's horns. But in Virgil's time, the sun was not in the constellation of the Bull at all when the year began (in the old sense of the words). The point where he crosses the equator had passed out of Taurus, over Aries, and had already entered Pisces at that time. The sun in Virgil's age was passing over the Bull's horns in the middle of May, a time which cannot by any astronomical or meteorological artifice be regarded as the opening of the year.* But in my chart for 3400 B.C., the sun was right on the Bull's horns at the beginning of spring.

Another passage in Virgil finds an explanation from the same chart. In his "Pollio," taken from a Sibylline prophecy of venerable but unknown antiquity, we find him saying,

> Jam redit et Virgo, redeunt Saturnia regna,

as if there were some connection between the constellation of the Virgin and the return of the beneficent influence poured forth by the sun in summer. Pope, indeed, in his introduction to his eclogue, "Messiah," goes so far as to draw a parallel between this passage and the well-known passage in Isaiah, "Behold a Virgin shall conceive and bear a son." But without entering into a discussion of the Virgin birth attributed of old to sun-gods, Osiris, Horus, Mithras, Serapis, Adonis, and the rest (and naturally ascribed later to such teachers as Zoroaster, Gautama, Plato, and others), we may at once find an explanation of Virgil's reference when we note that at the time to which all his astronomical passages must be referred, the sun—who was leaving Taurus in spring—was entering Virgo at mid-summer.

I might consider a number of similar matters, many of them of much interest, but that I should thus leave little space for the special discovery which I wish here chiefly to consider.

The celestial equator drawn for the year 3400 B.C. runs along the whole length of Hydra, the great sea-serpent, from his Heart, marked by the star Alphard (or the Solitary, known also as *Cor Hydræ*) to the tip of his tail. The head and neck are reared above the equator, that is, on its northern side, which for Egypt and Babylon would of course be above, and the two small constellations, the Raven and the Cup, which, though undoubtedly very ancient, were as undoubtedly parts of the Sea-serpent as well as independent constellations, rise above the equator, as if the body of the Sea-serpent showed here slightly above the ocean level.

This peculiarity of the starry skies of the time we are considering, recalls the old idea that around the heavens as around the earth is coiled a mighty serpent, associated with the ocean waves surrounding the frame of the earth. In the description of the constellations in the shield of Herakles we find (following Elton's translation) what corresponds closely with this peculiarity:—

> Rounding the utmost verge the ocean flow'd
> As in full swell of waters, and the shield
> All variegated with whole circle bound.

Remembering that the same poem describes the Dragon as "coil'd"—

> . . . full in the central field,
> With eyes oblique retorted that askant
> Cast gleaming fire,

which corresponds precisely with the polar position of the Dragon at the time we are considering, we see that the rounding of the utmost verge by the ocean "swell of waters" may fairly be regarded as extremely significant. It matters not in the least whether we adopt or reject the idea, thrown out by me eighteen years ago, that the original description of both the shield of Herakles and the shield of Achilles (two unquestionably solar heroes) related to the dome of a zodiac temple for the worship of the sun. It suffices that in each case the poem speaks definitely of the constellations. Each shield contained them, so that the object originally described undoubtedly presented the constellations as on a dome or hemisphere, or in a chart, and my sole contention here is that the reference to the Dragon as the polar constellation, and the sea waves as bounding the circuit of the constellations, indicates the period to which the picturing of the constellations belonged. In passing, however, I may remark that the identity of many lines in the two descriptions shows that in each we have part only of what was originally a much longer poem; and, while it is unlikely enough that objects like the constellations would be selected for the adornment of a warrior's shield, and improbable that in a group of songs like those composing the "Iliad," so long a description would be devoted to a mere shield (unless a poem already extant provided convenient material), it is utterly incredible that a poem so long as the original from which both "shields" were derived, should ever have related to such a subject as a mortal warrior's shield, or have been but part of a single book of an epic poem. The shield of Jove himself in the "Iliad" is described in four lines; the poem from which the shields of Herakles and of Achilles

* I may remark here that Chaucer is more careful in this matter, but has been blamed by Tyrwhitt for an error which he had not made. In the prologue to the "Canterbury Tales," he speaks of the time (which he there indicates as in April, and in other places marks as late in April) as that

> When Zephyrus . . . with his swoote breath
> Inspired hath in every holt and heath
> The tender croppes, and the yonge sun
> Hath in the Ram his halfe course y-run.

On this Tyrwhitt remarks that this would place the time of the pilgrimage in the end of March. But Tyrwhitt has confounded the sign with the constellation. Our almanacs speak of the sun entering Aries on the day of the autumnal equinox, meaning the sign, which for convenience still has its "first point" at the place where the sun crosses the equator. But the sun does not really enter the constellation of the Ram till a month later. Chaucer, who seems to have been well versed in the astronomy of his day, says rightly that the sun had run half his course in the Ram towards the end of April.

have been borrowed cannot have been much less than a thousand lines in length.

It was the recognition of the peculiar correspondence between the equator and the long body of the Sea-serpent (ranging past the zodiacal constellations, the Crab, the Lion, the Virgin, and the Scales) which led me to inquire into the position of some of the most remarkable constellations of the earliest known systems of astronomy. Naturally I turned first to the great constellation Argo, which is, or rather was, altogether the most striking of them all.

Let me, however, premise that few even among astronomers seem to understand how in ancient times the constellations were dealt with. It requires a long and careful study of old descriptions and old globes and pictures, to recognise what the constellations really must have been; and modern astronomers, those at least who are chiefly engaged in surveying the heavens, take little interest in inquiries of the sort. Most of them imagine that the constellations have always had about the limits assigned to them in modern charts. And since it is obvious that, as thus defined, the star groupings show for the most part very little resemblance to the various objects after which they are called, it is quietly taken for granted that men in old times called the star groups by names assigned for the most part in quite arbitrary fashion.

Mr. Lang, in his interesting volume "Custom and Myth," has an essay on star myths, which is partly based on the idea that there is no real resemblance in most cases between a constellation and the object after which it is named. "The most eccentric modern fancy," he says, "which can detect what shape it will in clouds, is unable to find any likeness to human or animal forms in the stars." Yet the forms are there in the star-groupings, in some cases so strongly suggested, that once noted they cannot readily be lost. Mr. Lang himself notes the Crown, where the resemblance is obvious when the heavens themselves are studied, and also easy when the modern constellation-maps are considered. The Dolphin is another example where the fitness of the ancient name is easily seen. A case or two of this kind ought to suggest that, in other cases, where the resemblance may not appear so obvious, and where there may be no resemblance at all when the modern constellation is examined, either some important changes have taken place among the stars themselves or else the modern constellation differs greatly from the old one.

Rejecting the former supposition as contrary to the evidence—for though stars have changed in brightness there is no evidence of changes numerous enough to spoil the old constellations—we examine the other. But here at once we find how the difficulty has arisen. The modern constellations not only differ from the ancient ones, but have been formed on an entirely different plan. The old constellations overlapped freely; the modern ones, on account of the special purposes which they are intended to fulfil, fit like the counties in a map of England. The care with which this requirement is now attended to belongs in reality to quite recent times, though probably even in the days of Hipparchus and Eudoxus something of the sort had been attempted. There are clear signs that even long after the Greek lettering of Bayer was adopted, the constellations remained somewhat overlapping. Thus the star which Bayer called Alpha Andromedæ he also called Delta Pegasi, as it formed an essential point in the configuration of both constellations. But as the modern astronomer does not care two straws for the mere configuration of the constellations and cares a great deal about simplicity and uniformity of nomenclature, one of these names had to be given up. Consequently the modern student of the stars looks in vain for Delta Pegasi in the charts. He finds Alpha, Beta, and Gamma, also Epsilon, Zeta, Eta, and so on, nearly to the end of the alphabet; but Delta Pegasi he cannot find. Yet the star which was so named is of the second magnitude. In like manner the constellation Auriga wants the star Gamma, which formerly marked the spot where Auriga overlapped Taurus. The star remains, of course; but it now only has one title, Beta Tauri, instead of being called also Gamma Aurigæ.

In modern charts, showing the constellations, we find lingering traces of the old usage, carelessly though these figures have been dealt with. Thus the Scorpion's claws had been for too long a time and too intricately mixed up with the legs of the Serpent-holder to be readily extricated. By a desperate effort the constellation boundaries have been kept apart, though both Scorpio and Ophiuchus have lost stars in the contest. But the figures showing these two constellations still present one claw of Scorpio amicably twined round one of the Serpent-holder's legs, the other extending behind the southern scale of the Balance. It may be noticed in passing that the Scorpion and the Balance illustrate the change from the ancient method in another way. It is well known that for a time the Balance disappeared from Greek star maps, notwithstanding its importance as a zodiacal sign, and its exceedingly ancient standing. Then the claws of the Scorpion were withdrawn and the Scales resumed their place, many imagining that the Balance then first took its place in the heavens. But this is an altogether mistaken position. They merely resumed the place which they had formerly occupied.

Now when we are no longer limited to the modern constellation outlines, in our search for the star-groupings in which men of old found resemblances to various objects, animate and inanimate, we can readily see where these resemblances were imagined. For instance, whereas the present Lion of the star maps, is an altogther feeble creature, with a nose like a rat, and no tail at all, the ancient Lion, whose head was on Cancer, its mane over Leo Minor, and the tail formed by the group called Berenice's Hair, while his hindpaws fell on the Sextant, and his forepaws over the Sea-serpent's head, was really a magnificent stellar animal, whose form can still be clearly recognised among the stars. So with the Bear: where our maps show his long tail—imagine a long-tailed bear and what the ancients would have thought of our raising such a nondescript to the heavens!—fell really the outline of a portion of his back. A large part of his body covered that ridiculous modern constellation, the Hunting Dogs; his head for a wonder has been left, and most neatly pictures the peculiar head of a bear (though it also served the Egyptians for the head of a hippopotamus), while the long plantigrade paws are also most characteristically indicated. He is chased, this real old Bear recognised by all the nations of antiquity from China to Peru (the long way round), by the Herdsman Bootes, with uplifted arms: so, at least, the old watchers of the stars saw the figure of the Ploughman; but modern astronomers have thought it necessary to deprive him of his right arm, which has been assigned to the constellation Corona. By modern astronomers in this case, I refer to the contemporaries of Hipparchus and Ptolemy. And so with many others of the most interesting of the ancient constellations. They have been separated where they formerly overlapped. Then pieces have been taken off them to form such ridiculous constellations as the Clock, the Painter's Easel, the Pneumatic Pump, the Flying Fish, the Chameleon, the Shield of Sobieski, and a host of other absurdities which discredit the memory of Hevelius, Lacaille, and others who, like them, should have known better.

(To be continued.)

XUM

HUNTING ALLIGATORS.*

THE Florida 'gator is a rare "bird" in its way, and a very formidable one, too, at times, but, like all celebrities, is sometimes used as the basis for some stupendous yarns. For instance, in a recent issue, a Newark (N.J.) authority (?) gives the *modus operandi* for catching and killing the saurian, when its skin is wanted. One method was to get the 'gator amused at some side-splitting (New Jersey?) tale, or else tickle him under the fifth rib, and when he opened his huge mouth in an amused grin, to seize the opportunity and thrust a big harpoon through his tongue. The 'gator would then good-naturedly butt himself against the bank until he felt the throes of final dissolution, when he would float up against the wharf, give up the ('gator) ghost and be in readiness to be skinned. Again, the spectacle of "Alligator Platt" riding on a 'gator's back, "geeing and hawing," so as to make a good landing, would make even the most ill-natured and fierce bull saurian that ever infested these waters, split his sides with loud guffaws! It should have been added to this that he trained them and drove them in pairs to plough his orange grove!

The 'gator is beset with dangers from the first, which probably accounts for his somewhat unfriendly disposition. The female finds some secluded sandbank exposed fully to the sun's rays, scoops out a hole two or three feet deep with her fore paws, lines it with old rubbish, grass, &c., and lays a layer of eggs from 25 to 200 at a time. These are carefully covered over to a height of three to four feet with grass, small sticks, &c. From the moment of laying the eggs scores of enemies are in wait. The big sand cranes and eagles are not averse to a good meal of 'gator's eggs, while bears, wild cats, and foxes take them as a great delicacy. Then comes the naturalist and curiosity hunter, and hundreds of eggs are gathered by these insatiable seekers. The old female is very fierce at this time, and lies in wait near by, and has been known to attack men even in the defence of her nest. Finally the young 'gators are hatched by the sun's rays, and the mound seems alive with what looks like young snakes. These young ones are smart and lively from the first. The old bull 'gator, with an idea of the good things of life, has been taking a sly interest in this incubation, and when the young ones get out he is on hand to take a good meal on infant alligator.

Many fights have been witnessed between the female and the male, in the former's defence of her young. The young ones, until they reach a length of a foot, are with the old female all the time. Their great delight is to lie basking on the sunny sand bank, clustered in one big mass. Upon the slightest alarm the old mother utters a hoarse call, opening wide her capacious mouth, and the youngsters scramble in for safety.

Formerly they were plentiful on all the streams and lakes in this State, but the indiscriminate shooting has scared them off into the more inaccessible bayous and lakes. In the lower portion of the State, in the everglades, they are hunted vigorously for their skins. Scores of hunters secure from 1,000 to 1,500 skins annually, and as they receive $1 each for them, they obtain what is to them a princely income.

"Alligator Platt," one of the oldest hunters in that section of the State, lives on Lake Tohopekoliga, and his stories of miraculous escapes from 'gators and bears are thoroughly enjoyed by the tourists who have the good fortune to hear him narrate any of them.

The best and most common mode of hunting them is by flashing their eyes at night, the same as deer stalking. Two generally hunt together in a canoe, one sitting in the stern paddling, the other standing at the bow, with a bull's-eye fastened to his head. They move on cautiously, the one in front coaching the course by slow motions of his hand. Hist! a warning hand is upraised, the motion of the paddle ceases, and the canoe glides on almost imperceptibly, the slight ripple at the bow being the only sound heard. The one with the rifle—a 44-calibre Winchester—slowly raises his weapon, peering expectantly forward, now to one side, then another. Suddenly a gleam is seen ahead like a coal of fire shining through the darkness, and the upraised rifle belches forth a stream of fire. A confused threshing, and, perhaps, a deep bellow follows; then all is still. If wounded the 'gator makes off to deep water, and if dead he sinks at once. The hunters do not stop for their game, unless in shallow water, and the 'gator is killed instantly, but go ahead and search for fresh victims. The next day they begin their look-out for their game. When killed the saurians sink at once, but the gases in the body bring them up in from six to ten hours. Hundreds are undoubtedly lost by being wounded and dying in some inaccessible creek or bayou, but the pot hunters care not. The skins are carefully taken off, and the carcases left for buzzards and other scavengers, though the teeth are generally secured if there is time. No portion is eaten, though some of the hunters delight to thrill the incredulous tourists with tales of living on alligator meat.

Last Christmas a good joke was perpetrated at a leading South Florida fashionable resort. It was a great headquarters for sportsmen, and game of all kinds was abundant on the table. On Christmas day, on the *menu* cards of the table where six jolly characters sat, was "venison" steak. It seemed to please them all greatly, and was called for repeatedly, and the cook was complimented for the fine dish. After dinner, as they were picking their teeth complacently in the reading-room—[such is, alas, the savage custom throughout the States.—R. P.]—the smiling host, a great wag, who never suffered himself to interfere with a good joke, called several of them into the office where a dozen or more others were gathered, and casually inquired regarding the "venison."

"It was remarkably fine," said a well-known Chicago banker; "so juicy and tender. Where was it killed?"

"Yes," interjected a New Yorker, a prominent yachtsman, who also prided himself on his ability to hunt. "It was prime. I shall have to try my luck at his kindred to-morrow."

"I certainly enjoyed it," remarked a Congressman from Ohio, a well-known epicure, too. "You know I always said you ought to give us more of that sort." Others joined in to the same effect, when the host, with a twinkle in his eye, said:

"Well, gentlemen, I am certainly glad you enjoyed that alligator steak. We can now find a good use for those fellows."

A moment they stood spellbound by his words, and then, as the full meaning burst upon them, their faces paled to ashy whiteness and they left for their rooms precipitately, whilst peals of laughter greeted the victims from those in the secret. For some time afterwards it was not safe to mention "venison" to any of the partakers thereof.

Generally, alligators are very timid, and they will seldom attack a man unless wounded and driven to a corner. Still, instances are narrated of old bull 'gators becoming pugnacious and attacking boats. Dogs, pigs, and small animals are seldom safe from their attacks, while cattle and horses have been known to suffer from their assaults. The

* Jacksonville (Fla.) correspondence St. Louis *Globe Democrat*.

big bull 'gators often go across country from one pond to another, sometimes going many miles. Where ponds or lakes are closely connected there is always found a well-beaten track leading from one to the other. Sometimes they are encountered on the road. These journeys are made near nightfall.

Besides their skin, the teeth are valuable, being made into "alligator jewellery"—charms, ear-rings, ring-bangles, &c. The teeth are generally secured by burying the head till it decomposes, and then picking out the teeth—a not very pleasant task. The teeth are then bathed in acids, which thoroughly clean and remove all unpleasant smell.

A full-grown 'gator is from 12 to 18 feet long, and displays a remarkable "openness" when he smiles in his own peculiarly engaging way.

CANALS OR RIVERS ON MARS?

DURING the present approach of Mars, who passed opposition on April 11, careful observations should he made by those who possess large telescopes, or have control of well-provided observatories, on the so-called "canals" of Schiaparelli, and especially on the duplication of the canals. The planet will be more favourably situated than Schiaparelli himself supposes for the investigation of these phenomena. He recognises in the appearance and disappearance of double canals a periodicity depending upon the Martian seasons, having observed that they come into view soon after the vernal equinox of the northern hemisphere, and gradually disappear—that is, fewer and fewer of them are seen—towards northern midsummer; and he has invited astronomers to observe whether similar phenomena are to be noticed after the autumnal equinox of the northern hemisphere—that is, after the vernal equinox of the southern hemisphere. But he does not notice that there is reason to expect a recurrence of the phenomena which have perplexed him (and by which he has perplexed many) as the autumnal equinox of the northern hemisphere approaches—and under more favourable conditions than after the equinox, because most of the "canals" are in the northern hemisphere of Mars.

Fig. 1 represents Schiaparelli's chart of Mars on a modification of Mercator's projection. A glance at it will serve to show observers of Mars that whatever may be the accuracy of Schiaparelli's observations, he has not correctly delineated the planet's aspect, while it will equally show students of physical geography and believers in the uniformitarian views now prevailing throughout science generally, that the "double canals" have probably no objective existence. Yet we cannot reject Schiaparelli's observations, renewed as they have been by himself at successive oppositions of Mars since the phenomenon was first observed, and confirmed by Celoria, Perrotin, and Trepied.

I suppose Schiaparelli himself has given up the wild notion suggested by him, and accepted by several of the ultra-cautious astronomers of the inductive school (in which rashness and caution strangely interchange places), that the canals and their duplications are the work of Martian inhabitants. For though a purely inductive philosopher (acting on the inductively cautious principle that everything observed is to be accepted precisely as observed, and not to be corrected by any such rash process as deductive analysis) might gladly accept the idea that Martian beings could first construct canals thousands of miles long and twenty or thirty miles wide, and then duplicate these in two years or so of terrestrial time, even inductive caution can scarcely be capable of believing that the second canal of each pair would be destroyed as each Martian summer approached and renewed soon after the next following spring.

The interpretation which, with deductive rashness, I suggested for Schiaparelli's observations soon after they were first announced seems so strikingly confirmed by his later observations and the recognition of a seasonal periodicity in the phenomena, that I venture to recall attention to it now, when it can be tested by observations which may prove even more effective, if not decisive. "Some difference of opinion," said the late Mr. Webb, "may possibly be expected concerning these strange appearances"—a tolerably safe prediction—"and the consequent enfeebling (to say the least of it) of the long-admitted terrestrial analogy may be, to some minds, unacceptable." I have one of those "minds," a mind which obstinately declines to give me the *otium cum dignitate* resulting, so far as I can judge, from the placid acceptance of strange observations as signifying just what they seem to signify, and not at any price to be interpreted according to known laws and established analogies. "But," Mr. Webb went on to say, "the established reputation of the observer"—Schiaparelli—"demands at any rate a respectful attention to his statements." With this opinion

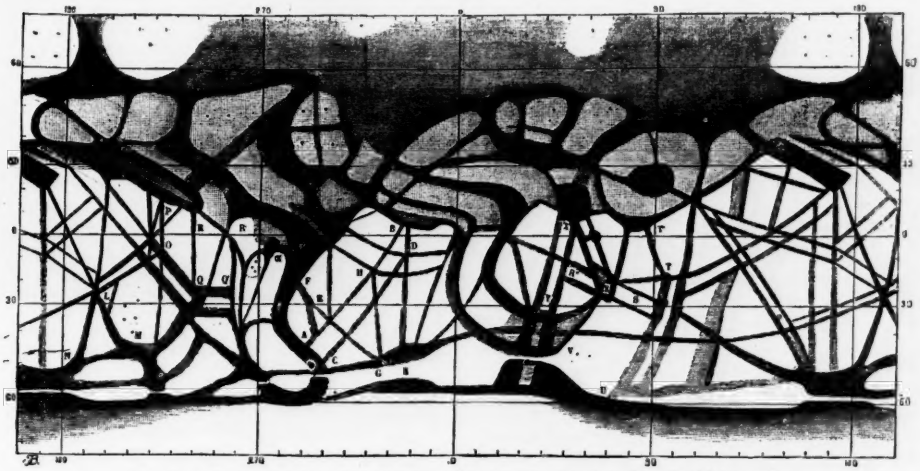


FIG. 1.—Chart of Mars by Signor Schiaparelli, showing his double canals.

I must express the fullest agreement: *only*, it has always seemed to me that when an observer of established reputation has made a series of striking observations, respectful attention involves careful examination of his work. If I were myself devoted to observation, and unable (as is the case with many of our best observers) to give much time to analysis, I should not be very grateful to those who claimed the acceptance of my observations precisely as they stood, without inquiry into their significance, or such due comparison *inter se* and with observations made by others as would be essential to their satisfactory interpretation. To this I may add that the basis of such analysis should always, in my opinion, be admitted analogies. I know of no theory now accepted as sound which ever had any other foundation.

I regard Schiaparelli's observation as one of the most interesting ever made by the telescopist. At the same time, I consider his "double canals" as having no existence in nature. "But," says the purely inductive philosopher, "he has seen them, and therefore they *must* be objective realities." Hevelius said the same of the star-discs which his telescopes showed him, and became quite angry (for an astronomer) when his measurements of those discs were

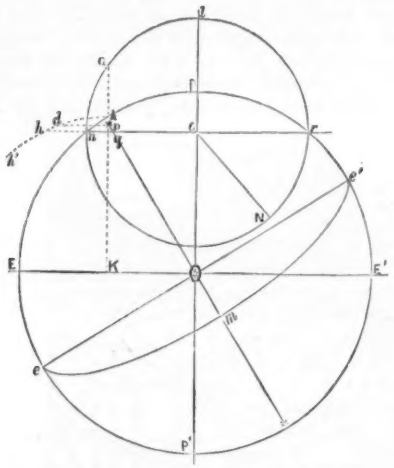


Fig. 2.—Construction for determining the axial pose of Mars on the meridian, May 1, 1881.

looked on with doubt. If his telescope had been a little better he would have seen not only seemingly well-defined and measurable star-discs, but a series of very obvious and unmistakable rings round each star. And probably the more simply inductive philosophers of his time would have been indignant (philosophically, of course) at those who would not admit the enfeebling, to say the least of it, of long-admitted solar analogies, and give such respectful attention to the observations of the eminent astronomer as would have been involved in the supposition that other suns than ours have immense rings round them, so situate through some strange influence that they are none of them foreshortened, but all appear exactly circular.

The interest of Schiaparelli's observations resides (for me) in the circumstance that they indicate the existence of an analogy between Mars and the earth, which, though long suspected, had never before been demonstrated. Unquestionably not duplicate canals on Mars, nor phenomena due to our own atmosphere, the double marks were as unquestionably seen: and we need not be in a hurry to say that "explanation is set at defiance," since there is nothing suggestive of inherent inexplicability in these appearances. On the contrary, we seem guided easily towards an interpretation which promises to remove every difficulty.

Parallel lines apparently seen where no parallel lines can be reasonably supposed to be, suggest certain optical phenomena in which we see parallel lines as the optical images of lines really single, circles as the optical images of points, and other optical products—as they may be called since they are not optical illusions—which by no means correspond with the real nature of the object under observation. The optical image of an exceedingly fine bright line on a relatively dark ground observed through a telescope is a broader bright line, on either side of which run two parallel lines much less bright, and outside these again other still fainter lines. Under particular conditions of relative lustre in the source of light the eye would recognise only the two relatively dark parallel bands on either side of the median bright streak of measurable width (depending on the aperture of the telescope employed).

Is it not, on the whole, more likely (to say the least of it) that what Schiaparelli has taken for sets of double canals are simply the two relatively dark streaks on either side of the bright diffraction images of exceedingly fine luminous streaks on Mars, than that those objects are really "double canals" on the enormous scale imagined, or that the

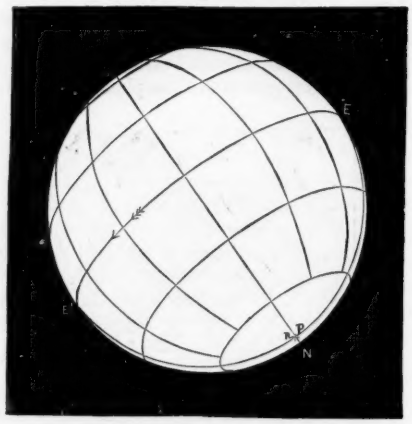


Fig. 3.—Meridians and latitude-parallels of Mars on the meridian, May 1, 1888, for an inverting telescope.

phenomena are otherwise wholly inconsistent with "admitted terrestrial analogies?"

The varying aspect of these objects would be readily explained on this supposition, nay, would be a necessary consequence of the hypothesis that the luminous streaks are Martian rivers, Moreover, the change of appearance would be likely to occur at precisely the season when Schiaparelli has found that it does occur.

Rivers on Mars would be far too delicate objects to be seen with their own proper outlines even with the most powerful telescopes, whether they were bright streaks on a darker ground or dark streaks on a lighter ground. It is not likely that there is any river so large as the Nile, probably there is not one so large as the Danube or the Volga on the planet Mars, and a river would have to be at least twenty times as wide as the Nile, taking the average of the lowest five hundred miles of its flow, to be seen with the telescope at Mars's distance. Usually a river if visible would be seen as a dark streak on the lighter background of the continent, just as the Martian seas are usually darker than the lands. Such a river would be perceptible, though not actually visible with its true outlines, through a good telescope, as a dusky streak many times broader than the river itself. But

if under special atmospheric conditions there were mists over the waters of the river, or the river being frozen remained snow-covered in spring after the snows had melted from its shores, the river would be bright on a darker background, and then the diffraction image of the river would appear as a broad band of light between a pair of parallel dark streaks. At other times the river would not be seen at all, the continent with its rivers being more or less enshrouded in cloud and mist.

It seems reasonable to suppose that (1) during the winter months of the northern hemisphere the rivers on Mars would not be visible, or would at least not be conspicuous; (2) after the vernal equinox the clouds and mists hiding the continents and rivers in great part from view would melt away, but would linger longest over the river beds; and (3) as summer approached the mists would melt away during the midday hours over the rivers also. The observations of Schiaparelli, as I have endeavoured to interpret them, correspond with this sequence; for (1) in the winter of north Mars no dark streaks are seen, or but few, and those indistinctly; (2) in the spring are seen the parallel dark streaks; and (3) towards summer the duplicated streaks become single.

Now during May, June, and July, Mars will be passing through the late summer and autumn of his northern hemisphere, and it will be interesting to inquire whether the dark single streaks, indicating clear skies over the river beds of Mars, change again into the dark double streaks indicating mist along the river tracks, before passing as winter advances, under those envelopes of mist and cloud, which will hide the rivers altogether from our view.

I give in fig. 2 the construction for determining the position of the polar axis of Mars, and the opening of the equator on May 1.* From that date onwards the planet's presentation will not differ importantly while the planet is favourably situated for observation, so that fig. 3, the projection for the inverted telescopic aspect of the planet (on the meridian) will serve well enough to the end of this Martian season.

WEIGHING THE EARTH.

(*Concluded from page* 125.)

THE principle of the method is illustrated in fig. 1. Here a and b are two small globes at the ends of a uniform rod $r\,r'$, suspended in a horizontal position by the cord or wire c C, attached to its centre C. The horizontal rod, left to itself, tends to a mean position which may be called the *position of rest*, though, as a matter of fact, when the suspension is as delicate as it has to be in the experiments considered, the rod never is at rest, but oscillates constantly, and very slowly, through short arcs on either side of its mean position. A and B are two heavy globes, which can be brought readily into such positions as are shown in fig. 1, where their attractions tend to draw a and b towards them in the directions shown by the arrows. The result of these disturbing influences is to sway the rod $r\,r'$ from what had been its position of rest, when undisturbed, to some new position of rest, as $n\,n'$ or $m\,m'$, about which it oscillates as before.

The processes of observation are as follows: First, the time of oscillation of the undisturbed rod is noted, to ascertain the force of torsion which has to be overcome to produce a given displacement. Then, the large globes being brought up to such positions as A and B, their distance from the positions of rest of a and b when these were undisturbed is carefully measured, and the new position of rest taken up by a and b is ascertained, the times of oscillation being noted throughout, so that any change in the torsion may be recognised and taken into account. This having been done, the globes A and B are removed to the mean positions M, M′, and the balls a and b are allowed to return to their position of rest. Then the globes A and B are carried round in the same direction until A is close by b on the left, and B close by a on the right, when their attractions tend to displace a and b in directions contrary to those shown by the arrows: the position of rest of the rod $r\,r'$ is next ascertained (the times of observation being throughout carefully noted) as before. From these observations, the attractions of the globes A and B on the balls a and b (or b and a) can be determined, since the times of oscillation indicate the torsion, and the position of rest determines how much of the torsion is overcome by the globes' attraction. By calculating next what the attraction of either globe would be if, instead of being at its measured distance from the neighbouring ball, it were at the earth's centre, and comparing this with the known attraction of the whole earth, we can ascertain how much the whole mass of the earth exceeds the known mass of the leaden globes: in other words, we can ascertain the mass of the earth, and

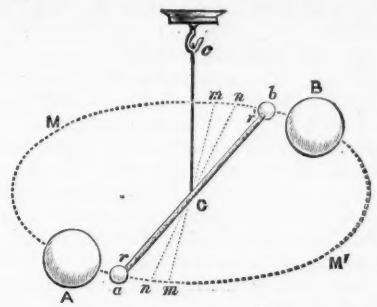


FIG. 1.—Illustrating the Principle of the Cavendish Experiment. (*Baily.*)

therefore—its volume being known—we can determine its mean density.

Cavendish, near the end of last century ("Phil. Trans.," 1798), applied this method in a form somewhat simpler than that described, but depending practically on the same principles, deducing a mean terrestrial density of 5·48. Hutton, re-examining Cavendish's experiments, reduced the deduced density to 5·32; but many prefer Cavendish's own treatment of his observations.

The experiments made by Cavendish were not very numerous, neither were those of Reich, of Freiberg, who in 1838 deduced by the same method a mean terrestrial density of 5·44. We must attach much more weight to the experiments made by Francis Baily in 1838–42, since they were not only conducted with singular care and caution, but were obtained in many different ways (though, of course, all by the same general method) and by a very large number of experiments. It will be well to give a few details respecting Baily's work, that the trustworthiness of his estimate of the earth's weight may be fully recognised.

The rod $r\,r'$, fig. 1, of $6\frac{1}{3}$ feet long, was of light wood (in nearly all the experiments), and was suspended in various ways in the different experiments, viz., on single copper wire ·0178 inch and ·0219 inch in diameter; on two parallel iron wires 0·177 inch, 0·367 inch, and 0·415 inch apart; on two brass wires 0·380 inch and 0·415 inch apart; and on two silk fibres 0·177 inch, 0·367 inch, 0·380 inch, and 0·415 inch apart. At the ends of the rod were attached balls of dif-

* See KNOWLEDGE for February 1, 1884 (vol. v.), p. 71, for an account of the simple process to be followed in all such cases.

ferent material and size in different experiments, viz, 1½-inch platinum, 2-inch ivory, 2-inch glass, 2-inch zinc, 2-inch lead, 2½-inch lead, and 2½-inch brass. In a small number of experiments (fifty-six) the wooden rod was replaced by a brass rod without balls. The torsion rod and its suspension were enclosed in a case with a glass at one end. The devices by which the effects of electricity, magnetism, radiation, and other disturbing influences were as far as possible eliminated need not be described, nor the multitudinous experiments considered by which explanations of irregular discordances were sought for or corrections introduced. Nor is it necessary to describe or picture Baily's instrument either as a whole or in detail—the general principle of his method, already sufficiently explained, being all that is wanted and all that the student really needs to understand. Let it suffice to note that the experiments for the correction and explanation of discordances were more numerous than those actually employed for the determination of the earth's mean density.

The experiments thus used amounted in all to 753. Of these, however, 56, above-mentioned, when only a brass rod was used, were not seriously intended for the determination of the earth's mean density. They are well described by De Morgan as "a defiance to the apparatus to fail if it could." Yet they indicated a mean density below 6—a result much nearer the truth than the Harton Colliery experiments had given, costly and complicated though they were. The remaining 697 experiments gave results ranging from 5·5 to 5·847. The mean value deduced by Baily (due weight being given to each set of experiments) was 5·66.

Cornu, in 1872, applying the same method with improvements suggested by recent scientific developments, obtained the value 5·56. He did still better work in applying to the more numerous experiments of Baily, as recorded, corrections justified by recent physical discoveries. He found that as thus corrected Baily's elaborate and beautiful experiments indicated a mean earth-density of 5·55.

The following table presents the results of the application of Michell's method:—

Cavendish	5·48
„ (revised by Hutton)	5·32
Reich	5·44
Baily	5·66
„ (revised by Cornu)	5·55
Cornu	5·56
Mean	5·51

The true mean value of the experiments made by this method, due weight being given to each result, and Cornu's revision of Baily's experiments being accepted, is so near 5·55, that this may fairly be taken to represent the most probable mean density of the earth, the error being probably not more than 0·5—in other words, the density of the earth probably lies between 5·5 and 5·6.

Taking the earth's mean density at 5·55 times the density of water, the earth's mass=590,654,000,000,000,000 tons.

The earth's equatorial radius contains in round numbers 20,926,200 feet, the polar radius being $\frac{1}{289}$ less, and 35·943 cubic feet of water weigh one ton. Hence, the earth's mass, expressed in tons,

$$=\frac{5\cdot55}{35\cdot943}\left(\frac{4}{3}\right)(20{,}926{,}209)^3\left(\frac{288}{289}\right)(3\cdot14159)$$

which when duly worked out (the use of logarithms will greatly help the reader who cares—as every reader should—to test the calculation) gives the above value.

There is a method by which, I think, the mass of the earth might be directly compared with that of a known mass of lead or other heavy metal, without the difficulty arising from the varying torsion, under varying conditions, in the Michell method. The plan suggested (but in an unworkable form) by Professors Richer and Mayer, of the Berlin University, will be readily understood from figs. 2 and 3. A B D is a globe of lead, which might be three or four feet in diameter, whose centre is at C. At M, the highest point of this globe, a small steel block is set, on which rests the knife-edge *c* of a balance *a c b*. The large globe A B D is pierced along the vertical directions A D and B E, immediately under the extremities *a* and *b* of the balance-arms *c a* and *c b*, in such sort that the balance can be used to weigh bodies either above A B or below D E, or one above A B and the other below D E, as in the case illustrated in fig. 2, where a weight *w* above A is weighed against a

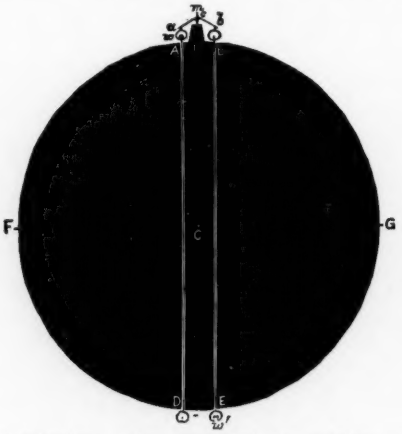


Fig. 2. Illustrating a plan suggested for weighing the earth directly against a globe of heavy metal.

weight *w'* below E. Fig. 3 shows the balance on a larger scale, and illustrates the arrangement suggested as best for applying the weights. Immediately above the centre-piece *c* (the knife-edge of which rests on the horizontal surface *k l* at *e*) is a thin plate of polished steel which, when the balance is level, has its plane at right angles to the then horizontal direction *a b*. A horizontal beam of light from a distant source, situate either on the left or on the right of the apparatus as pictured, falls on this steel mirror, and when the balance-beam is level returns after reflexion upon its horizontal track, but when the beam is inclined the return ray is inclined to the horizon. Thus the reflected ray practically serves as a very long index by which to measure the deflection of the balance. [In the actual experiments the light could be sent out and received as in the observations for determining the velocity of light by Fizeau's and Wheatstone's methods.] Two weights exactly equal and similar suffice for all the experiments, but preferably four should be provided, so that in any set of experiments there need be no occasion to transfer a weight from above the large globe to below or *vice versâ*. It would be desirable also that sets of weights of different materials should be employed, so that diversities depending on the physical qualities or inter-relations of different substances might be eliminated. The weight-holders are shown in fig. 3 at *p*, *q*, *p'*, and *q'*. Their construction should be such that with the least amount of disturbance a weight, such as is shown at *p* and *q'*, may be added, removed, or transferred, as the experiments proceed. The scale-pans and weights should depend from knife-edges at *a* and *b*, in the usual way where delicate weighing is required.

The method of the experiments is as follows in a case where a full set of four weights is employed:—

All the four weights to be used in a given set of experiments are to be first carefully weighed against each other, in pairs, above A B and below D E, every pair being thus tested, each weight in each test being put on one side of M in one trial and on the other side in another, and the indications of the long light-pointer carefully noted in each of the twenty-four trials thus made. [Six pairs of weights can be selected from the four; and taking any pair, w and w', these can be weighed against each other in two ways in the upper weight-holders, and in two ways in the lower, or four ways in all. Thus twenty-four weighings must be made to eliminate all errors arising from differences—however minute—between the weights.] Next each pair of weights must be balanced against each other, one being above and the other below. One such trial is illustrated in fig. 2. The weight w above A, which should exactly balance the weight w' set in the scale-holder above B, will not balance

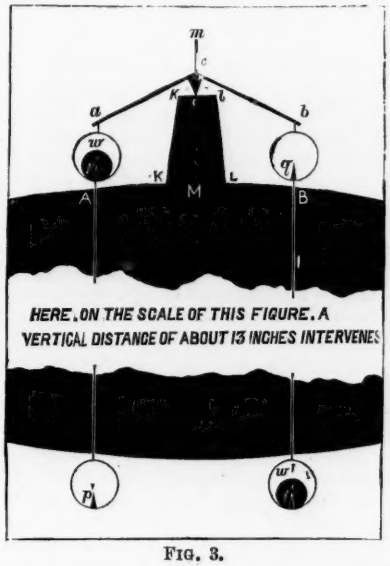


FIG. 3.

w' set below E. For while each is drawn downwards with equal force by the earth's mass—or with only such minute and calculable difference as results from the distance of w from the earth's centre being greater than the distance of w'—w is drawn towards C, or *downwards*, by the attraction of the great globe A B D, while w' is drawn towards C, or *upwards*, by the same attraction. The amount of deflection, as indicated by the light-pointer, is to be carefully noted; then the weight w is to be transferred to B and the weight w' to D, when an opposite deflection will take place, which is to be similarly noted. Next the two experiments are to be repeated, the weight w' being above and the weight w below. Corresponding experiments are to be made with each of the six pairs of weights which can be formed out of the four. The mean of the observed deflections compared with the mean of the twenty-four preceding observations (in all of which the beam is approximately horizontal) will supply the means of comparing the attraction of the earth with the attraction of the globe A B D. Of course many details must be taken into account: as, the weight of the wires or cords along A D and B E; the angles such as C w D and C w'B when w and w' are in equilibrium; the difference of the distances of w and w' from the earth's centre; and the like. But all such matters are readily calculable from the original data and the indications of the ray-index.

Here is a rough calculation of the effects we may expect to recognise in such experiments:—

Supposing the globe A B D to be of lead, and therefore of twice the mean density of the earth, and 4 feet in diameter, its mass compared with that of the earth is as $2(2)^3$ to $(10{,}500{,}000)^3$; but the weights w and w', neglecting their distance from the surface of the large globe and from the vertical diameter, are only 2 feet from the centre of the globe, while they are 10,500,000 feet from the centre of the earth. On this account the attraction of the globe is greater than the attraction of the earth as $(10{,}500{,}000)^2$ is greater than $(2)^2$; and since the attraction of the globe is exerted upwards on one weight and downwards on the other, we must regard it as doubled, and this doubled attraction as practically again doubled by the interchange of the ends of the balance from which the upper and lower weights are severally suspended. It follows that while the attraction of the upper globe, so far as it depends on mass, is less than the earth's in the ratio

$$2\,(2^3) \text{ to } (10{,}500{,}000)^3$$

it is increased, through the diminution of distance and the adjustment and interchange of the weights, in the ratio

$$4\,(10{,}500{,}000)^2 \text{ to } (2)^2.$$

Hence, finally, the effect of the leaden globe's pull, quadrupled as in the experiments, bears to the effect of the earth's pull the ratio compounded of these two, viz., the ratio

$$16 \text{ to } 10{,}500{,}000.$$

So that if our balance, with its ray-index, is delicate enough to measure a difference of weights amounting to about $\frac{1}{656000}$ of the weight used, we may expect this plan to afford a direct, and in that respect satisfactory, comparison between the mass of the earth and that of a globe of known size and density.

[It might seem as though the slight difference of distance of the two small weights from the earth's centre might be neglected. Lord Brougham incurred some just ridicule for the rather strange mistake of asserting that a man can carry a weight more easily over his shoulder than in his hand, because in the former position the weight is farther from the earth's centre. But in delicate experiments such as we are considering in the text, the difference due even to a few feet of distance must be taken into account. Thus, suppose A C to be 2 feet, or w rather more than 4 feet farther from the earth's centre than w'; then, since the earth's radius contains in round numbers 21 millions of feet, we may take w' to be $\frac{1}{5000000}$ nearer the earth's centre than w, by which difference the attraction of the earth on w' is increased by $\frac{1}{2500000}$ part. This, though minute, is appreciable, even considerable, in relation to the quantities we are dealing with in these experiments.]

ELECTRIC LAMPS FOR COAL MINES.

BY WM. LANT CARPENTER.

IN an article on miners' lamps and colliery explosions in the April number of KNOWLEDGE, Mr. W. Mattieu Williams alludes at the end in very brief terms to the electric lighting of mines. This may be, and is, done in two ways. In some cases the main thoroughfares, and many of the branch ones, are lighted by glow lamps, which are permanently fixed, and supplied with current from a dynamo machine, sometimes above, and sometimes underground, driven usually by a steam-engine. The greatest progress made lately, however, is in the construction of portable lamps, containing either primary

batteries or small accumulators. The weight of several patterns of these scarcely, if at all, exceeds the weight of some patterns of oil lamps at present in use. They give a light for at least twelve hours without any attention, exceeding in intensity that of the ordinary oil lamp, and they can be placed in *any* position, so as to illumine the roof, the floor, or the sides of the mine, wherever the coal is being "got." In fact it has been objected that they give *too much light*, and that miners who use them are liable to be frightened when they see the risks they run! The incandescent filament is doubly protected, first by its own globe, secondly by a very strong glass cap, and sometimes there is water between them, as a precautionary measure. I entirely demur, however, to Mr. Williams's statement that "the breaking of the glass bulb of an incandescent lamp would expose a filament of burning carbon nearly as dangerous as a flame," and I venture to think that if Mr. Williams had tried to explode a mixture of fire-damp and air by breaking such a lamp in it, he would have found it a much more difficult task than he imagines. As a matter of fact, the filaments used in these small lamps are so minute, that even if they escape being quenched by the water (supposing that to be present) there are only very few explosive mixtures which they can be made to fire. Mr. Williams's last objection, that "their worst defect is the absence of warning which is given by the behaviour of the common lamp flame," was met more than a year ago by Mr. J. W. Swan (formerly of Newcastle), with whose lamp I am tolerably familiar. To this lamp a most ingenious firedamp indicator is attached, which not only gives warning, but enables the overman, or even the trained miner himself, to ascertain, by an observation lasting only a few seconds, how much (within 0·5 per cent.) firedamp is present in the atmosphere at the moment of observing.

The question of comparative cost can, of course, only be arrived at by the use of these lamps on as large a scale as oil lamps are now used, in some large well-managed mine. As some thousands of these lamps are coming into use, we may shortly expect some reliable data on this point. I may conclude by pointing out that, in the case of those lamps run by portable accumulators, the process corresponding to lamp trimming is of the simplest possible description. In the base of each lamp are two tiny sockets; when the lamps are handed in at the end of the shift's work, the sockets of each one are fitted on to a pair of wires projecting from a board on which hundreds of such lamps may be placed. These wires are in connection with the terminals of a dynamo, and thus, while the miners are above ground, one engineer charges the whole of them, while his engine is probably doing other work as well. Can anything be simpler?

DISEASE GERMS.

NONE of the results of modern scientific research are more interesting than the discoveries relating to disease germs. Apart from the relation of these discoveries to the diseases which affect humanity, they are of interest as disclosing to us a world of minute life, of which in former ages men had scarcely even any conception. They regarded plague and pestilence as specially appointed visitations, not as obeying laws as strict, though (even now) by no means so well understood, as those regulating the development of the higher forms of animal or of vegetable life. Possibly some of those who are anxious to find constantly fresh proof of the truth of the saying that there is nothing new under the sun, may consider that the modern theory of living death germs is embodied in the sixth verse of the ninety-first Psalm, where (following the Prayer-book version) we are told of the "pestilence that walketh in darkness," and the "sickness that destroyeth in the noon-day," but, on the whole, such an interpretation must be regarded as far-fetched; and, certainly, so far as definite statements are concerned, the theory of poison germs must be regarded as less than a century old. Within that time one disease after another has come to be regarded as resulting from the development of invisible germs by a process something akin to fermentation, sometimes more suggestive of algoid life.

I do not propose to do more than touch here the general theory of disease germs, considering more fully only the evidence we have of the possibility, in certain cases, of developing innocuous germs from those which produce destructive diseases.

At the outset I would touch on the curious question whether a process akin to natural selection in the germ world may not modify the character of these germs in ways resembling those which have been adopted for their artificial modification. The various forms of life represented by these minute organisms have their stages of development like the higher forms of life, but lasting a much shorter time, so that within a very short portion of the life even of an individual man, hundreds of generations of germ-life may pass. Again, the lives of these germs doubtless depend on their environment; and the various species so undergo during the course of many generations changes akin to those which affect (in many generations of their much longer lives) the higher orders of life, animal and vegetable. Hence, during the lifetime of an individual, and far more during several generations (as we measure time) the character of the disease germs to which small pox, typhus fever, scarlet fever, measles, and other such zymotic diseases are due, may undergo marked alteration. We could thus understand the more or less deadly character of such diseases in particular years, and also in particular regions. We can also understand that some of the diseases of ancient times which seem to have disappeared may in reality be represented by diseases of the present day which resemble them in certain respects, but are nevertheless distinct diseases, and in particular differ markedly in destructiveness.

For example, the plague, as known in Europe only two centuries ago, has certainly no modern representative in the countries where it was once so greatly feared—if it exists anywhere. What is to-day called "the plague" in Oriental countries is a different disease. Yet there are reasons for believing that our typhus fever is in reality akin to the "black death" of old times. The story is well authenticated which tells how in the place where certain victims of the great plague of 1665 were buried, death and disease lurked in wait, and nearly two centuries later found victims among workmen employed to dig in the place where a pit had been prepared for the corpses too numerous to be buried in separate graves. But the illness which fell upon four of these workmen, and on seventy others who contracted it from them, was not the plague but simply typhus fever. Assuming, as we may fairly do, that the germs of the plague disease caused the fever which attacked these nineteenth century workmen, we have evidence that the typhus fever of our time is the direct descendant of the plague of former ages. For, as Miss Florence Nightingale neatly put the problem of the propagation of disease, small-pox can no more generate scarlet fever, or scarlet fever measles, than a race of dogs can produce a race of cats, or a race of cats a race of rabbits. Typhus, generated by germs of the plague disease, indicates clearly the kinship of the two diseases, distinct though they now seem.

The evidence is not quite so clear in the case of vaccinia and small-pox; since it has not yet been demonstrated that protection against a particular disease can only be given by passing through a disease actually akin to it. It might be argued that as the particular effects of quinine which give protection against malaria argue no kinship between malaria and the action of quinine, so the protective influence of vaccine inoculation does not necessarily prove that the germs which produce vaccinia (the disease, if so it can be called, following vaccination), are the same in species as those which produce small-pox.

Still, in the light of recent evidence respecting zymotic diseases and germ diseases generally, it may be regarded as practically certain that the disease germs of vaccinia are the direct descendants of small-pox germs, which, during their residence in the heifer have undergone a certain modification rendering them innocuous; while, nevertheless, introduced into the blood of the human body, they produce that particular change which results in what we call "protection" against small-pox. This being so, it may be regarded as probable that in the case of any other disease known to be produced by germs, methods of cultivation may be discovered by which the disease germs may be so cultivated as to lose their fatal power, while generating a disease sufficiently akin to the more dangerous illness to render the patient safe thereafter or for a while against its influence. So that, as I pointed out several years since, when as yet such expectations were regarded as fanciful, typhus, scarlet fever, diphtheria, and a host of other ailments, which are known to be due to the presence of living organisms in the blood or tissues, may be treated as we now treat small-pox.

I may touch here on the ideas of that troublesome and foolish class of persons who call themselves "anti-vaccinationists." The strict action of the vaccination laws in England—a country whose people have by no means been disciplined into such strict obedience to Government control as continental nations—has excited opposition, not only from persons who recognise the mischief of undue interference with the people, but also from those who are too ignorant to be capable of appreciating the evidence respecting the protective influence of vaccination. A Herbert Spencer may reasonably object to laws forcing the unw'ser and emphatically least valuable portion of the population to protect themselves against disease and death. But such objections to compulsory vaccination are not to be confounded with the idiocies of the Anti-Vaccination League. Those who object to compulsory vaccination *qud* compulsory. are among those who recognise most clearly the protective influence of vaccination. But inasmuch as this protection is open to all, and will be taken advantage of by the most sensible, while the spread of small-pox from the foolish sort who will not seek this protection, can always be prevented by renewed vaccination among the rest, it is evident that compulsory vaccination tends to preserve the unwise opponents of vaccination—a decidedly mischievous result considered in itself. The very fulness of a man's appreciation of the value of vaccination as a protective against small-pox, may conceivably lead to his objection to compulsory vaccination. It by no means follows that a man does not approve of a good thing because he is unwilling that every one should be compelled to partake of it; often quite the contrary, in fact.

It ought to be unnecessary to cite evidence of the protective influence of vaccination, but I may here note two cases which seem to me singularly striking:—

1. Zurich Canton. The law of compulsory vaccination was repealed in 1883. Official returns recently published by Professor Dunant, enable us to judge how many of the more foolish sort (unfortunately, their babes for the most part, but in such questions we must consider the class not the individuals) would have been preserved had the law been left unchanged. The death rates from small-pox between 1881 and April 1886, were as follows:—

Date.	Deaths.
1881	7
1882	0
1883	0
1884	11
1885	73
First quarter of 1886	85

2. In Germany vaccination is compulsory; in France it is not. Now, Dr. Jassen points out among many other striking examples of the efficacy of vaccination that during the year 1885, in twenty-one towns in Germany, having an aggregate population of 4,000,000, the deaths from small-pox numbered twenty-seven; in fifteen French towns, having the same aggregate population, the deaths from small-pox amounted to 866.

The significance of such results, which might be almost indefinitely multiplied, will be recognised still more clearly when we remember that deaths from small-pox are far from being the worst results of an epidemic of the disease.

It is noteworthy that men who seem careless about applying the protective influence of vaccination to their own families show a marked zeal in seizing at any protection for their cattle which kindred methods may provide. Thus, though Pasteur's researches into the terribly destructive disease known as splenic fever (sometimes called anthrax or charbon), were at first ridiculed and his conclusions opposed, the proprietors of flocks and herds agreed with admirable unanimity in accepting his means of protection as soon as the validity of his system had been demonstrated. The history of anthrax is instructive. The disease resembles the black plague in its action and in the rapidity with which its effects are developed. In bad cases death occurs in twenty-four hours. Where the disease is very prevalent proprietors have been ruined by the entire destruction of their flocks and herds. Between the years 1867 and 1870 no less than 50,000 deaths occurred among horses, cattle, and sheep in the district of Novgorod, in Russia, while 568 human beings perished to whom the disease had been in various ways communicated.

Pasteur's inquiries into the development of anthrax were characterised by the same combined patience, ingenuity, and keenness which he had shown in his researches into pebrine, the silkworm disease. So soon as he had recognised the true nature of the anthrax bacillus he studied methods for cultivating it so as to mitigate its poisonous effects. His method consisted (or rather consists) in cultivating the bacillus in meat-juice or chicken-broth, to which air has access but not dust. A certain time is allowed to elapse before it is employed for inoculation. If this period does not exceed two months the virulence of the bacillus is little diminished; but if it is extended to three or four months, the disease produced by inoculation is less severe and a considerable proportion recover; if the time is prolonged to eight months the disease produced by the bacillus is so mild that none of the inoculated animals perish, all quickly regaining full health and vigour, while all are safe, for at least a considerable period, from the deadly attacks of the veritable anthrax.

It was not until a crucial series of experiments (such as cannot be made when human beings are in question) had been carried out, that Pasteur's system of treatment was adopted. A flock of fifty sheep was at his disposal. He vaccinated (to use a convenient if not quite correct expression) twenty-five of these with the cultivated anthrax poison, repeating the operation a fortnight later. All the animals thus treated passed through a slight illness, but at the end of the month were as well as the remaining twenty-

XUM

five. He now inoculated all fifty with the strongest anthrax poison, predicting that within twenty-four hours, or before six o'clock the next day, the twenty-five which were inoculated for the first time would all be dead, while the others would be perfectly well. A large number of cattle proprietors, veterinary surgeons, cavalry officers, and others interested in animals, gathered next day on the field where were the subjects of the experiment. At two o'clock twenty-three of the unprotected sheep were dead; the twenty-fourth died at three; the twenty-fifth at four. But the twenty-five vaccinated sheep were all in perfectly good condition. One of them, who had been purposely inoculated with an extra dose of the poison, had been slightly indisposed for a few hours, but he was now as well as the rest.

It is hardly necessary to say that the experiment was regarded as decisive. Cattle owners needed no persuasion to induce them to adopt Pasteur's system.

Pasteur's researches in regard to hydrophobia are in some respects still more interesting, because they relate to a malady which is derived directly from external matter, not propagated from disease germs. It would not be possible to describe here the way in which Pasteur dealt with the original inquiry into the part microbes play in this terrible malady; or to discuss the various processes which he tried for cultivating the hydrophobic microbe into a form which should be innocuous yet protective. All the world now knows that he has succeeded. In case protection cannot be secured by a single inoculation, as with small-pox and anthrax, a series of inoculations have to be performed, each more stringent, so to speak, than the preceding, until at last the inoculations are such as would kill a patient not prepared by previous inoculations.

The difficulty in cases of hydrophobia, so far as inoculatory cure is concerned, is that the full poison has been already received by the system, may even have been at work for many days, before the milder forms of the poison are injected. It might well have been supposed that the fatal first-comer would be first in its action, and therefore death inevitable. Probably Pasteur had little hope at the beginning of his researches that he could cure the bitten, expecting only to protect the unbitten. But it turned out otherwise. Pasteur's system may be regarded as now a demonstrated success. The proportion of deaths among the cases dealt with has been so much smaller than among similar numbers not protected by Pasteur's method as to assure us of the protective value of his system even at this early stage of its adoption; while the cases in which the system has failed have been without exception such as from the beginning presented small room for hope, the bites being exceptionally severe, or on the head, or by mad wolves, and the interval before the protective system was employed being unduly long. Professor Ray Lankester correctly presented the results of Pasteur's work when he said that "unless we assume falsehood, such as for wickedness and folly would scarcely ever have been equalled, we must recognise Pasteur as having obtained results which of themselves will for ever place him high among the benefactors of the human race."

Lockjaw, though it is usually the result of wounds given by substances not likely to convey disease germs into the system, is beginning to be recognised as due to microbes already existing in the blood, and made actively mischievous by local inflammation around the wound, generally lacerated, which is the original cause of the trouble. Whether any method of treatment will hereafter be suggested by this discovery, should it be eventually demonstrated to be real, remains to be seen.

We are justified in believing that as protection has already been found against some germ diseases by taking advantage of naturally cultivated (and mitigated) germs as in the case of small-pox, or of artificially cultivated germs as in the case of anthrax, so protection may be obtained against cholera, diphtheria, typhus, scarlet fever, and other more or less destructive diseases which have been clearly shown to be due to specific disease germs.

FAIRIES, ELVES, AND DWARFS.

By Stella Occidens (Mary Proctor).

Like that Pygmæan race
Beyond the Indian mount, or fairy elves
Whose midnight revels by a forest side
Or fountain some belated peasant sees
(Or dreams he sees), while overhead the moon
Sits arbitress, and nearer to the earth
Wheels her pale course; they on their mirth and dance
Intent, with jocund music charm his ear.
At once with joy and fear his heart rebounds.

Paradise Lost.

ELVES and dwarfs, though minute in themselves, yet form a prominent part in the folk-lore of Europe, and many wondrous legends concerning these beings have been handed from ages down; a nurse's tale,
Which children open-eyed and mouth'd devour,
And thus, as garrulous ignorance relates,
We learn it and believe.

In Scandinavian mythology Alfheim is the home of the light elves, who are fairer than the sun, and about whom we hear very little. The dark elves live underground in Svartalfaheim, and are blacker than pitch. They are full of mischief, but can be good-natured little beings when they wish. Their sooty appearance is explained by the fact that they work in the mines underground, and forge metals which are found in the caves and mountains. These dwarfs, it is supposed, are very skilful in metal-work, and also in magic, on which account they are greatly feared by the peasants, who dare not provoke them. Many years ago the dwarfs had a great conflict with superior beings, and being defeated, were compelled to dwell in the caves and underground. From other accounts we read that they were formerly a race of Oriental Lapps, who immigrated into Sweden and Norway later than the Finns, who were the descendants of the giants, and are therefore the oldest of the races that now occupy Scandinavia.

The dwarfs who dwell in the mountains are reported to own vast treasures of gold and silver, whilst the chambers of their palaces are supported by jasper columns, and the walls glisten with crystals and precious stones. In fact, these little beings have been actually seen pushing large chests full of gold and silver from one hill to another, in preparation for one of the grand entertainments they often have among themselves. They do not like noise, and it is supposed that their almost total disappearance from the country is due to the ringing of church bells. The elves or hill-people are an entirely different race, though they also live in mountains and caves, are very rich, and have a great dislike for noise. They do not work in the mines, but love music and dancing. They are commonly called *huldrefolk*, and their music is called *huldreslaut*. On summer nights, when the moon is shining, they can be heard on the elfin hills, and those who have been fortunate enough to hear them say that their music is mournful and chanted in a minor key. If a word should be spoken during their song, it will be turned into wailing, as by this their hope of salvation is destroyed. The peasants believe that these beings contain the souls of the departed who thus expiate their sins on earth. Some of the Norse fiddlers

have learned the *huldreslaut* by listening carefully, and a few can play the elf-king's tune, which is so magical in its power that all who hear it, and even inanimate objects, are compelled to dance. The unfortunate fiddler must continue playing until he can play the air backwards, or someone comes behind and cuts the strings of his fiddle.* The stromkarls are so musical that trees dance and waterfalls cease flowing, to listen to the enchanting strains of their music.

The *nisses*, who also belong to the dwarf family, resemble the German *kobolds* and the Scotch brownies. They render great services to thrifty housewives, who often find all their work done for them in the morning. Unlucky is the house which is not favoured by their presence. They usually dress in grey, and wear a pointed cap.

Sometimes the Northern dwarfs called on their neighbours in Denmark. We read about the old goblin king of the Dovrefeld, who visited the Danish elfin king, and in whose honour a grand banquet was given. The most select were invited, and the will-of-the-wisps lighted them on their way. Some mischievous little imps led them into bogs, but those were principally the church-dwarfs [I trust nothing inconsistent with due respect for the Church is here intended.—R.P.] or the night-ravens, who were not very welcome at any time. Grand preparations were made for the reception of the king, and the palace was gorgeously decorated with gold and silver, which glistened in the moonlight with which the floor was bathed. The fairy elves were clad in gauzy raiment of moonshine and mist, and they shivered, as the king from the North, with his ice crown, and the icicles hanging from his beard, drew near. We are told that he was enchanted with the dancing of the Danish king's youngest daughter, and returned with her to Norway.†

The Russian dwarfs are not quite so pleasant to deal with, being malicious and spiteful. They are called *leshy*, or wood-demons, which does not sound promising. The following legend is an instance of their evil habit of stealing. Once upon a time a fair maiden went for a stroll in the woods, without her father's permission, and lost her way. She was not seen again for three years, when a hunter passing through the forest, also lost his way. He looked around him to discover where he was, when he spied a little moujik sitting on a log, plaiting a shoe. The strange little being kept looking at the moon, saying—

"Shine, shine, O bright moon!"

The hunter gazed in wonder at the little mortal, who, though only two or three spans high, was as grey as an old man. But the dwarf read his thoughts.

"Grey am I," said he, "being the devil's grandfather."

The hunter then recognised in him a wood-demon, and taking aim, he shot at him. The moujik was wounded, but managed to crawl home. The hunter followed him till he came to a hut in the fissure of a rock. Opening the door he saw a maiden standing beside the *leshy*, who was now dead. He persuaded her to return home with him to his village, where she was recognised as the lost one.‡

A German dwarf would have fared much better than the unfortunate little moujik, for he would have put on his little invisible cap, and vanished before the hunter could take aim. These elfish goblins wear a pointed red cap, which makes them invisible whenever they wish. They are very full of mischief, and have been known to rob a neighbour's pea-field, using the peas at night to pelt the windows of a house belonging to someone who had annoyed them They have also been known to steal fair maidens, and one was kept for nearly eight years by an elfin king. Some of the dwarfs are very ill-shaped and ugly, and have duck's feet. In fact, this was proved by the good people of the little village of Arlisbach. One very severe winter the dwarfs would come every night to a house and sleep on the oven, but would vanish at dawn. They wore scarlet cloaks reaching to the ground, so that their feet were never seen. Some prying people sprinkled ashes in front of the house, and next morning, sure enough, the marks of duck's feet were to be seen. The little dwarfs were so angry at being discovered that they never came again, "and never will while men are so spiteful."*

The peculiarities of these dwarfs resemble the Norse. Like them, they live in rocks and woods, are great smiths, and forge iron and jewels. These smiths wear light grey coats and blue caps, and are often heard at night working at the forge. The elves are also very industrious, and spin and weave under the direction of Dame Holda. If one passes by an elfin-hill at night, and listens carefully, he can hear the elves spinning and the wheels humming, and it is supposed that the flying gossamer is spun by them. Then there are elves who are fond of music and dancing, and they can be seen on the moonlit meadows, but they vanish at dawn, leaving their footprints in the dew. They have been known to teach people to play on the fiddle in exchange for a grey sheep. It appears that the pupil has no chance unless he is fat; if he is thin he never gets beyond learning to tune the fiddle. If he is fat he must practise till the blood flows from his finger-tips; then he can play such enchanting strains that "the trees shall dance, and torrents in their fall stand still." This melodious stromkarl loves to linger by mills and waterfalls, and is to be seen on calm dark evenings, when he entices people by his music, like the Norwegian *fossegrim*.†

Some of the dwarfs are supposed to have made the knot-holes in the trees, and in Smäland it is said an elfmeid came into a house through a knot-hole in the wall, floating in on a sunbeam. She was married, stayed awhile, but four years later suddenly vanished the way she had come.

In South-East Germany many legends are told about wild-folk, moss-folk, and wood-folk. They scamper over mossy dales, and climb steep precipices inaccessible to human beings. These little mannikins are old and greyish-looking, and clothed in moss. Some are not good-natured, and live in the denser parts of the forest. They wear "green garments faced with red, and black three-cornered hats," an elf-like combination. The little wood-wives often come to woodcutters and ask them for something to eat and drink, and in return they will render them any service in their power.

The following is an example of the numerous legends told about these interesting beings. It refers to the belief that good luck would befall any one who could obtain a drinking-horn belonging to the fairies, even apparently though the horn were stolen. One hot summer's day Count Otho of Oldenberg, fatigued with hunting and overcome with thirst, threw himself on the ground, exclaiming, "Oh, for that I could have a drink of clear water!" To his surprise a beautiful maiden stood before him, holding in her hand a silver goblet filled to the brim with water. Count Otho drank it, but was so ungrateful as to run away with the goblet. However, he saved himself from the evil consequences which might have followed this rash act by giving it to the Church. As the goblet was of solid silver, and handsomely carved with delicate tracery in the Gothic style, it was a valuable gift. Perhaps the Count's account of the way in which he came into possession of this piece of silver was not so strictly truthful as might be wished.

* Anderson, "Norse Mythology," p. 202.
† Anderson's "Fairy Tales: The Elfin Hill."
‡ Ralston, "Russian Folk Tales," p. 213.

* Grimm's "Teutonic Mythology," p. 451, vol. ii.
† Ibid., p. 493, vol. ii.

XUM

NEVADA'S WALTZING GIANTS.

"UT in Nevada," said a mining man from White Pine, "we have the sublimest dance that any man ever saw. We call it 'the dance of the giants.' Great cylinders of sand, from eight to twenty feet in diameter, and sometimes immensely tall, come careering across the desert with a whirling, waltzing motion that is very graceful. I have often seen them when they must have been two or three miles high, for their tops reached into the clouds. But oftener there will be one big column, with a lot of little columns attending it, all waltzing together. The effect is the strangest thing imaginable. It is both sublime and grotesque. It inspires you with awe, and at the same time fills you with the desire to laugh at the odd performance. And, if the man is superstitious, the weird, fantastic sight can make him feel mighty uncomfortable.

"They are never seen except in the summer time, and are most frequent in July. They have their beginning in some incipient whirlwind, which snatches up a handful of sand while the surrounding air is still, and then they keep on growing and moving onward.

"They are not like the cyclones farther east, for they move with very little noise, and, instead of being funnel-shaped, are of the same size from top to bottom. The motion is the same, being both circular and advancing. They draw up into the cylinder fabulous quantities of sand, tons of sage-brush, and sometimes good-sized stones.

"How far they travel nobody can tell. The very big ones must have waltzed along in their silent majesty over the lonely deserts for a long distance. They must travel the whole distance of the White Pine Valley, three hundred and fifty miles, and sometimes they come down through Spring Valley from Idaho to the Peranegat Valley."

THE STARS OF OTHER TIMES.

I DO not think I am a very lazy man; and in regard to mapping and charting, I think—though it may be sheer self-conceit—that I have at times been exceptionally hard-working. Probably not many thousands, or even hundreds, or tens of persons have given so much as 400 hours to a single map—possibly not one besides myself (unless I be thought somewhat beside myself to have undertaken such a work). Therefore I am not ashamed to explain the devices by which, when I can, I simplify the work of charting. I will go further. I regard the use of easy methods, when these are sufficiently accurate for the object aimed at, as akin to the use of those abridged processes of calculation by which the mathematician who has sufficient experience to work confidently in such ways, leaves out all such portions of the ordinary processes as are not essential. The average calculator will multiply and divide right out, extract his square roots and cube roots to the bitter end, take out every logarithm to the seventh figure, and determine, with like accuracy, the numbers corresponding to his logarithm, when all he needs (nay, perhaps, all he can at all trust) in his results may be three or four significant figures. This really is not accuracy; it is blundering: it is the result not of scientific care but of inexperience, very often in the weariness resulting from over precision of process the calculator makes mistakes seriously affecting the numbers finally deduced. In like manner, in mapping there are many devices which not only save trouble but secure a greater accuracy than the precise geometrical methods theoretically applicable to the problem.

Such is the method which I am about to describe as the one I have employed for preparing star maps showing the heavens at given hours and seasons, in given latitudes, at given epochs in the past history of the human race.

Take Maps I. and II. in Knowledge for March and April last. Having chosen any epoch and found the pole for that epoch, on the circle indicating in each map the pole's precessional path, it would be sufficiently easy to describe in each map the circle indicating the diurnal track of the zenith of the heavens around that pole for any given latitude—for instance, a circle 60° from the pole for the latitude of the Great Pyramid. It is also not difficult to set points round a circle thus determined so that they shall correspond to hour-differences of time—that is, to divide the circle into portions each representing 15° on the corresponding circle of the sphere. To complete further the projections of the visible hemisphere corresponding to such points as these for zenith points (*i.e.* centres of projection), is a sufficiently simple piece of stereographic charting—*theoretically*. But all this work involves careful attention to the details of the problem, some mathematical mental gymnastics, and certain geometrical processes which require considerable care and some skill in the execution. Then, owing to the unequal shrinkage of the paper, the results obtained by thus describing circles according to the principles of the stereographic method, are not so accurate as they theoretically ought to be.

The following is the method I actually employ in such work:—

I lightly draw in pencil the course of the circles of declination and right ascension in my "School Star Atlas" (dated 1880) among the longitude and latitude lines and stars of Map I. I then ink them in strongly, correcting while doing this the small irregularities affecting the light pencilling. Next I make two tracings of these lines (really circles and circular arcs) in red ink on tracing paper, one of these to be used with Map I., the other with Map II.

Suppose, now, that the epoch for which I want a series of maps like my "Half-Hours with the Stars," for England (latitude 51½° N.), or for the United States (latitude 38° N.), or for the southern hemisphere (latitude 38° S.), is that of the building of the Great Pyramid—I first find the right position of the poles for the year 3350 B.C., and the corresponding crossing points of the equator of that epoch on the ecliptic. (This, of course, requires only that the right arc for 3,150+1,880 or 5,030 years' precession, where the whole circuit requires 25,868 years, should be taken on the ecliptic and on the pole's path.) Then these three points being marked, the prepared tracing papers are adjusted—one over each map—so that the pole corresponds with the polar point thus determined and the equator crosses the ecliptic at the two marked points. When the tracing papers are gummed at the edges or corners in this position, the red circles and arcs are the declination-parallels and hour-circles of the heavens, for the epoch dealt with.

Now to obtain maps presenting the stellar skies of any latitude, we draw first on any projection we please (in my "Half-Hours" and "Seasons Pictured," I use the equidistant) the hour circles and declination-parallels corresponding to the latitude. This, of course, is a process depending on familiar principles of mapping [but I may take occasion hereafter to show how it may be conveniently effected for any projection, when once effected for the most convenient projection—the stereographic]. Then, having made twelve tracings (on drawing paper preferably) of this projection, we fill in the stars for these from Maps I. and II., the red

lines over which are meridians and declination-parallels corresponding to those in our tracings, the central meridian on each tracing being made to correspond successively with 0^h, II^h, IV^h, &c., up to $XXII^h$; or, if we care for more precise information, we make twenty-four maps presenting the stellar skies at hourly intervals for each night and at bi-monthly intervals round the year.

A NEW LOTTERY SWINDLE.

IN all the United States, save one, lotteries are regarded as illegal. That one State, Louisiana, professes to permit lotteries only for educational or charitable purposes, which does not prevent the State-supported lotteries of Louisiana from being conducted on a system whose only claim to fairness lies in the barefacedness of its unfairness. It openly proclaims itself a swindle, so confident is its trust in the folly of the majority, who will always pay ten dollars for a five-dollars' chance of winning a great prize. Unluckily the Louisiana Lottery leavens with its unwholesomeness the whole lump. In every State the advertising of the Louisiana lottery swindle is pursued more or less openly. The evil even reaches the old country, as I happen to know from personal experience; for having proclaimed openly the iniquities of nearly all lottery schemes and the folly of gambling generally, I am naturally regarded by the lottery scamps as secretly hankering to try my chance. So that from America and from the Continent, even from Australia, invitations reach me to invest in lotteries openly proclaimed in their own advertisements dishonest and delusive.

In passing, I may remark that if I believed in luck I should certainly be tempted to venture in some of these lotteries; for twice, though not from desire for gambling gains, I have tried my luck (as the foolish ones put it) in lotteries, and each time I have won a goodly prize. One trial occurred in Melbourne, Victoria, where I had been taken round the Chinese quarter, visiting opium dens, Chinese lottery dives, and so forth. The method of marking the Chinese lottery papers was explained to me by a practical example; I paid, that is to say, for the right, and made marks at random with the vermilion brush as instructed. The rest of the company did the same. I certainly supposed I was paying a shilling away—without any likelihood of seeing it again—for the opportunity of learning how the Chinese lottery men managed their little game. But next morning the sum of 29*l.* was handed over to the leader of our party, my share being 4*l.* 2*s.* 10*d.* The other case occurred at a bazaar in Boston, held in October 1873 by the Sisters of the Good Shepherd for a most excellent purpose. I bought tickets in a raffle for a gold watch, regarding their price as my contribution to the charity; but next morning a gentleman called in at the Parker House with the watch, which it seems I had won. I kept the watch, but preferred to pay the cost price, not caring to have my charity mixed up with anything so degrading, in my estimation, as gambling.

In England, lotteries at bazaars are still permitted, or rather are still winked at, for, strictly speaking, the law forbids them. Various magazines and journals also have lotteries more or less disguised, prizes being offered to purchasers of the serial who may make lucky guesses of various sorts. The law can hardly touch these cases, since the right to a guess is not ostensibly paid for, but thrown in, along with the serial itself, in return for the shilling, sixpence, twopence, or whatever the sum may be which the serial costs. But recently the law relating to lotteries has been broken in a singularly daring manner. A form of lottery which has long been in vogue on the continent of Europe (sometimes known as the Geneva system) has been reproduced in principle, or want of principle, though the details have been craftily altered in such sort that the system has an innocent, parlour-pastime aspect.

In the Geneva Lottery System (considered fully in my little book on "Chance and Luck") there are ninety numbers, and at a "drawing" five are taken out in succession at random. The public, before the drawing, have been entitled to buy a chance for any price, within certain limits, which they may like to pay. Thus a purchaser may take any one of the following chances:—(1) He names a single number of the ninety, receiving *fifteen* times his stake if his number is one among the five drawn; or (2) he names a single number and the position it is to occupy among the five drawn, receiving *seventy* times his stake if his guess is right; or (3) he names two numbers of the ninety, receiving *two hundred and seventy* times his stake if both appear among the five drawn; or (4) he names two numbers and their position, receiving *five thousand one hundred* times his stake if his guess is correct; or (5) he names three numbers of the ninety, receiving *five thousand five hundred* times his stake if all three appear among the five drawn; or (6) he names four numbers of the ninety, receiving *seventy-five thousand* times his stake if all four appear among the five drawn.

These ventures are called respectively, *simple* number, *determinate* number, *simple ambe*, *determinate ambe*, *simple terne*, and *simple quaterne*.

How much of rascality there is in the system will be seen from the following little table, showing the prize actually given and the prize which should have been given in each case, if the chances were properly dealt with as in a fair wager between man and man:—

TABLE SHOWING PRIZE ACTUALLY GIVEN AND PRIZE EARNED.

Venture.	Actual Prize.	Proper Prize.
Simple number . . .	15 times the stake	18 times the stake
Determinate number . .	70 " " "	90 " " "
Simple ambe . . .	270 " " "	400½ " " "
Determinate ambe . .	5,100 " " "	8,010 " " "
Simple terne . . .	5,500 " " "	11,748 " " "
Simple quaterne . . .	75,000 " " "	511,038 " " "

As the lottery-loving public always prefer to try for large prizes, not noticing how small the chances are of getting them, the more risky ventures in the above list were those chiefly taken, and it will be observed that these are the ventures for which the prizes are most inadequate. Thus, for simple terne, the total amount paid in prizes would in the long run be less than half ($\frac{5500}{11748}$) of the amount paid in; while for simple quaterne the total amount paid out would be less than $\frac{3}{20}$ of the amount paid in.

Of course the promoters of Continental lotteries on this system carefully published every case in which a great prize was won, knowing well that the general public would never guess the real significance of these cases. Every venture won on simple terne meant more than eleven thousand lost. Every venture won on simple quaterne meant more than five hundred thousand lost.

The recently invented plan depends on letters instead of numbers, but in principle is precisely the same as the Geneva system, and is worked on the same crafty and fraudulent lines. The promoters call themselves the "National Prize Competition Society"—the guessers are called "competitors," be it observed—and the scheme is advertised as "a novel system of money-making," the public fondly imagining that *they* are to make the money. The

plan is this: For sixpence any one can buy a ticket marked thus , or sets of several tickets at a slight reduction, the average of the various prices being as nearly as possible five pence. On receiving a ticket the victim marks in a letter of the alphabet in each of the four divisions of his ticket, putting in any letter he likes. (The conditions say that *any* letter can be marked in in each square, so that the same letter, if the "competitor" pleases, might be marked in more than once; and as the "society" is similarly free to mark in any letter on each square, this possibility must be taken into account in considering the value of each probability.) The "competitor" posts his ticket, lettered according to his guessing, on Friday, and on the same day the "society" sends out to him by post a corresponding ticket, lettered as they please, so that his guess and their selection cross on their way.

If none of the competitor's letters correspond with the society's letters, he simply loses his sixpence. If one letter of his only is the same as the letter marked in the same square on the society's ticket, the competitor receives a shilling, or twice his stake. If two letters of his correspond with two, square for square, in the returned ticket, the competitor receives ten shillings. If three letters similarly correspond, the competitor receives 3*l.* or 5*l.*, according to the position of the squares thus correspondingly filled—a distinction for which there is no real reason so far as the probabilities are concerned: we may conveniently put 4*l.* as the average price paid for this triple success. Lastly, if all four squares are rightly lettered the "competitor" receives 100*l.*

Not one in a thousand probably of those who buy tickets in this lottery has any clear idea of the value of his chances for the respective prizes. The promoters of such schemes know this, though the Louisiana Lottery schemers daringly decline to clothe their iniquity, so confidently do they trust in the general idiocy of their victims. As a matter of fact, the calculation of the chances offered by the "National Prize Competition Society" is sufficiently simple. But those among the readers of these lines for whom it would be easy could make it for themselves, and those for whom it would not, could not easily follow any explanation; so I simply give the results.

Assuming the power of putting any letter whatsoever out of our English twenty-six on each square, there are 456,976 possible ways of filling in the ticket. Comparing these with any definite ticket filled in by the society, 390,625 will be wrong as to all letters; 62,500 will be right as to one letter; 3,750 will be right as to two letters; 100 will be right as to three letters; and *one* only will be right as to all four letters.

To determine the extent of the swindle, suppose these results, which represent the average proportions in any long series of trials, all duly paid for at the rates above mentioned, then there will be paid out:—

62,500*s.*	for single correct letters.	
37,500*s.*	for two	„ „
8,000*s.*	for three	„ „
2,000*s.*	for four	„ „
Total . 100,000*s.*		paid on prizes.

The sum paid in, at 5*d.* for each of the 456,976 tickets, would be 190,407 shillings, and it is in this degree that the public, in purchasing large numbers of tickets on this plan, are wronged. That is, they pay 190,407 shillings, and get back on the average only 100,000 shillings on each set of 456,976 trials. But the promoters of the scheme have to pay one halfpenny for each ticket issued, and charge a penny for postage—according, at least, to their circular; so that they actually make 228,488 pence, or 19,041 shillings, more, by this seemingly slight overcharge for postage. At a moderate computation of the expense for printing tickets, advertising, &c., the "National Prize Competition Society" make the usual proportion of profit on the lottery they conduct, viz., between eighty and one hundred per cent! It is at this rate that the Louisiana Lottery Company get the better of their foolish victims. The Geneva, Hamburg, Brandenburg, and other lotteries, get similar gains.

The "National Prize Competition Society" advertise their lottery scheme as "a novel system of money-making"—and truly, in one sense. The deluded public suppose the money-making is for them, but the society attends to that part of the business, and, though the system is in reality old enough, yet it has been so clothed in a new garb that it takes in the weaker sort just as thoroughly as though it were altogether new.

How it has come to pass that, as I am told, the law has not yet stopped the "novel system of money-making," and punished the law-breakers, I know no more than I know how it comes to pass that respectable serials have permitted the "National Prize Competition Society" to advertise in their columns.

THE RELIGION OF THE ANCIENT BRITONS.*

PROFESSOR RHYS'S satirical reproach in his preface that "of course it is not pretended that anything connected with the history of religion among the Celts—or among the Teutons, if it comes to that—could vie in popularity with the pedigree of the last idol unearthed in the East, or even with the discovery of a new way of spelling Nebuchadnezzar's name," is fully warranted. For we have been indolently content to remain in shameful ignorance concerning the question of the religion of the races dominant in these islands before the Roman invasion. Our training, both at home and school, on Sundays as well as on week-days, has fostered this ignorance. Classical studies have usurped, and still unduly usurp, the scholar's time, as if all of value in the history of mankind is confined to a strip of Mediterranean seaboard. Romulus and Remus, Cecrops and Pisistratus, are familiar names to the student; perchance he has heard of Arthur, but not of Nud and Manannan MacLir. He knows the Iliad and the Odyssey, but not the songs of Edda and the breezy, bracing sagas, the Volsung and the Niblung, which, as William Morris says, "should be to all our race what the Tale of Troy was to the Greeks." And, in like manner, as the old artificial division of history into "profane" and "sacred" shows, instruction in the religious development of mankind rarely, except to point a false moral or a misleading contrast, passes beyond the age and races covered by the Bible.

For the larger number of folk, the political history of Britain begins with the invasion of Julius Cæsar, and its religious history with the mission of Augustine. Out of the material gathered by the famous emperor, as the result of personal observation, and by Tacitus, whose information was, however, secondhand, a few sentences describing the general features and mode of life of the "ancient Britons" were spun, and then the story of the successive invasions which resulted in the "making of England" was woven according to regulation pattern. Whether the wild tribes

* "Lectures on the Origin and Growth of Religion, as illustrated by Celtic Heathendom." By John Rhys, Professor of Celtic in the University of Oxford. (Williams & Norgate: 1888.)

of the northern and western parts, and the somewhat more advanced tribes of the southern parts, of the island were aborigines, and if not, whence they had come, and what was their relation to the races overspreading the northern hemisphere, concerning whom no written records exist; what remains, either tangible, as weapons of war and the chase, or intangible, as language, legend, myth, and custom were extant, neither historians nor antiquaries tarried to ask. What a vast and interesting, if obscure, field they left unexplored we are beginning to see, thanks to the industry and zeal of Professor Rhys and kindred labourers. The old indifference and ignorance, due not only to defects of education just referred to, but also to the delusion that "when Britain first at Heaven's command arose from out the azure main," she succeeded to the spiritual lordship and privileges which the Jews had forfeited,* and appeared equipped, Minerva-like, complete in all wisdom needful to eternal salvation, are giving place to the desire to know whether the course of man's progress in these islands runs parallel or not with that of other civilised races, and if so, what evidence is supplied by survivals.

It is as a contribution to this question that Professor Rhys's volume, in which the history of religion is for the first time comprehensively treated from the Celtic point of view, demands attention. Its somewhat late place in a valuable, if unequal, series itself illustrates our remarks on the tardy recognition of the importance of ancient British religions, but better late than never, and we will not lay reproach at the doors of the Hibbert Trustees, who are spending their money to good purpose.

Rarely has a more obscure and tough subject been taken in hand than this with which Professor Rhys bravely grapples, for the materials are not only scanty and scattered, but are often hard to interpret. They consist of a few references in ancient writers, and of inscriptions on votive tablets and other monuments preserved in local museums and described in transactions of provincial societies. Drawing primarily on Cæsar's account of the Gaulish religion, which may be taken as applicable to the religion of the British Celts, since they migrated from Gaul, Professor Rhys has sought to identify the Gaulish with the Roman Pantheon. He remarks that, "unfortunately for the study of Celtic religion and philology, few of the monuments of Gaul supply us with inscriptions in the national tongue; and probably all of them, whether in Gaulish or in Latin, date after the advent of the Roman conqueror and the initiation of his policy of assimilating the gods of vanquished Gaul with those of Rome. This policy took a very definite form under Augustus. He, as *pontifex maximus*, united the religions of the Roman world; but the manner in which Africa and the East were treated could not be recommended in the case of Gaul and Spain; so when he undertook to restore the position of the *Lares* and *Penates* he included among them the Gaulish divinities, who were henceforth styled *Augusti*. The result in each instance was that the name of the Gaulish god came to be treated more or less as a mere epithet to that of the Roman divinity, with which he began to be regarded as identical: thus the Gaulish Grannos became Apollo Grannus, and Belisama became Minerva Belisama, and so in other cases. . . . In a word, the Gaulish gods and goddesses were reduced in rank, and forced, so to say, to become more or less Roman; but they were not banished or in any way proscribed." The search for resemblances is justified not merely by the similar polytheistic stage of the conquering and the conquered races, but by their common, if remote, relationship, Celts and Romans being members of the scattered Aryan family. As illustrating the method adopted in this volume: when Cæsar speaks of the Gauls as making Mercury the inventor of arts, the patron of trades (as he was among the Romans) and of roads and journeys, Professor Rhys cites an inscription in which the god is described as Mercurio Aug. Artaio, the Gallic affix being cognate to the Celtic *âr*, plough-land. Again, Mars, god of war, is equated with the Gaulish god Caturix, a compound meaning king of war or lord of battle, tablets having been found near Geneva and elsewhere with this inscription, Marti Catur(igi), &c. Cæsar tells us that Mercury was worshipped as supreme, and the degradation of Mars, who was once the chief Celtic god, to the third place (Apollo being second) is, as Professor Rhys remarks, probably due to the progress of the people in the arts of peace.

How far the author has succeeded in his laborious attempt none but Celtic scholars can determine; and even were we competent to deliver judgment, our readers would resent the introduction of the abstruse and tedious matter which this would involve. They may share our reliance on the caution and accuracy which have thus far distinguished Professor Rhys's investigations, and may follow him with confidence through this labyrinth where lurk the disguised and disfigured gods whom our predecessors worshipped, and who have in many cases still further eluded us by becoming changed into the kings and heroes of romance. Certain it is that the Celts had their departmental deities, and that the characters of these were more or less akin to nature-gods of other polytheistic races. Among these stand out the Celtic Apollo, healing sun-god, Belenus, the reputed founder of Caerleon, and from whose name some derive Billingsgate; Aine or Aina, queen of heaven, mother of the gods; Taranis, god of thunder, to whom certain trees and plants are sacred; Manannan MacLir, a sun-god; Nodens, or Nud, and his *alter ego* Lir, sea-god, worshipped both in Britain and Ireland. During the Roman occupation a temple was erected to Nodens at Lydney on the Severn, his wife being the Irish goddess of the Boyne, while Lud, whose name reappears in Shakespeare's "Lear," and whose daughter figures in Celtic romance, perhaps survives among us in London, if that name be not, as some antiquaries think, derived from Llyn-Din, the "lake-fort." Upon this Professor Rhys has the interesting remark that "the association of Llûd, or 'King Lud,' as he has come to be called in English, with London, is apparently founded on a certain amount of fact: one of the Welsh names for London is Caer-Lûd or Lud's Fort, and if this is open to the suspicion of having been suggested first by Geoffrey, that can hardly be supposed possible in the case of the English name of *Ludgate* Hill. The probability is that as a temple on a hill near the Severn associated him with that river in the west, so a still more ambitious temple on a hill connected him with the Thames in the east; and as an aggressive creed can hardly signalise its conquests more effectually than by appropriating the fanes of the retreating faith, no site could be guessed with more probability to have been sacred to the Celtic Zeus than the eminence on which the dome of St. Paul's now rears its magnificent form."

But besides the major gods of the Celtic Pantheon, there is a crowd of *dii minores*, both native and borrowed, spirits of forests, springs, and rivers, which last had their own special divinities, as shown in the Dee and other streams with kindred names. The mountains were dedicated to airy powers; every village was protected by the

* A delusion of course rampant among the eccentrics who believe in the descent of Britons from the lost Ten Tribes, and who identify the British Lion with the Lion of the Tribe of Judah! As showing the prevalence of this craze, the Catalogue in the Subject-Index of Modern Works issued by the British Museum gives thirty-two books on the identity of Britain with Israel published between 1882 and 1886.

XUM

"mothers," or guardian spirits, who appear in mediæval legends as the White Ladies, the three fairies, the weird sisters, the wild women of the woods; while in the giants and dwarfs and the fairies and goodies of nursery legend other minor deities reappear. Forming a dark background to this spritely company, we find another and older creed, familiar to us as Druidism, concerning which the most foolish speculations and bizarre theories have been broached. Upon this Professor Rhys has much to say which is of interest, and in connection with which we advise the perusal of his little book on "Celtic Britain,"* as also of the chapter on the religion of the British tribes in Mr. Elton's scholarly and delightful "Origins of English History."† As this latter book is out of print, it may be well to quote the opening sentence from Mr. Elton's fine chapter:—

> The religion of the British tribes has exercised an important influence upon literature. The mediæval romances and the legends which stood for history are full of the "fair humanities" and figures of its bright mythology. The elemental powers of earth and fire, and the spirits which haunted the waves and streams, appear again as kings in the Irish annals, or as saints and hermits in Wales. The Knights of the Round Table, Sir Kay and Tristram, and the bold Sir Bedivere, betray their divine origin by the attributes which they retained as heroes of romance. It was a goddess, *Dea quædam phantastica*, who bore the wounded Arthur to the peaceful valley. "There was little sunlight on its woods and streams, and the nights were dark and gloomy for want of the moon and stars." This is the country of Oberon and of Sir Huon de Bourdeaux. It is the dreamy forest of Arden. In an older mythology it was the realm of a King of Shadows, the country of "Gwyn ab Nudd," who rode as Sir Guyon in the "Faerie Queene,"
>
> And knighthood took of good Sir Huon's hand,
> When with King Oberon he came to Fairyland.
>
> The history of the Celtic religions has been obscured by many false theories which need not be discussed in detail. The traces of revealed religion were discovered by the Benedictine historians in the doctrines attributed to the Druids; if the Gauls adored the oak-tree, it could only be a remembrance of the plains of Mamre; if they slew a prisoner on a block of unhewn stone, it must have been in deference to a precept of Moses. A school pretending to a deeper philosophy invented for the Druids the mission of preserving monotheism in the West. In the teaching of another school the Druids are credited with the learning of Phœnicia and Egypt. The mysteries of the "Thrice-great Hermes" were transported to the northern oak-forests, and every difficulty was solved as it rose by a reference to Baal or Moloch. The lines and circles of standing stones became the signs of a worship of snakes and dragons. The ruined cromlech was mistaken for an altar of sacrifice with the rock basin to catch the victim's blood and a holed-stone for the rope to bind his limbs.

In inquiring into the origin and nature of Druidism, it is necessary to have a clear idea of the succession of races in Britain prior to the Roman invasion. We may leave out of this list the men of Palæolithic times who ranged the country under a more or less arctic climate, waging war against the huge mammals of the Quaternary epoch, and whose chipped tools and weapons are found in the river-drifts and under cavern floors, for it is certain that no continuity of race can be proved between these savages and any tribe or nation now found in North-Western Europe.

Between their disappearance and the arrival of a more advanced race great physical changes occurred, Britain having been submerged, then raised, reunited to the Continent, and then finally separated. But the Britain of Neolithic and far later times, down to a period long subsequent to the Roman invasion, was, in its superficial features, not the Britain of to-day, but a land of fen and forest, the highways through which determined the ancient boundaries of its several kingdoms. Despite Mr. Ruskin's Jeremiads on the degradation of the climate of England through the blotting out of her skies with "Manchester's devil darkness, and sulphurous chimney-pot vomit," and of the troubling, not as by the angel at Bethesda, of her streams with the pollution and filth of her factories, we are in much better case now than then. When the legions of Cæsar first disembarked they found the island little better in most parts than "a cold and watery desert. According to all the accounts of the early travellers the sky was stormy and obscured by continual rain, the air chilly even in summer, and the sun during the finest weather had little power to disperse the steaming mists. The trees gathered and condensed the rain; the crops grew rankly, but ripened slowly, for the ground and the atmosphere were alike over-loaded with moisture. The fallen timber obstructed the streams, the rivers were squandered in the reedy morasses, and only the downs and hill-tops rose above the perpetual tracts of wood." The herds of mammoths, rhinoceroses, and other pachyderms; the cave-lions, cave-bears, hyænas, and other beasts of prey, that had roamed through the jungles and wallowed in the rivers during the alternating polar and tropical climates of the Old Stone Age, had vanished, and in their place wild boars and oxen (the *urus* of Cæsar), elks and other animals, for the most part extinct, tenanted the forests and swamps. Wolves prowled over the long desert that stretched from the Cheviots to the Peak; beavers built in the streams; and only the cry of the cormorant and other sea birds broke the silence that reigned over the expanse of peat-bog that stretched inland on the west, over the swamps of the midlands, and over the dreary fens that spread in monotonous flatness eastwards. Masses of forest so dense as to be in some districts impenetrable, stretching, as did the Andredsweald, one hundred and twenty miles, with wide expanses of moor and swamp, that surrounding the higher ground where Ely Cathedral now stands exceeding sixty miles across; narrow strips of arable, and wider breadths of pasture land, spread over the estuaries and across the inland valleys—such, broadly outlined, were the features of England from pre-Roman times till a thousand years later, despite much that had been accomplished by the military spirit of the Romans and the industrious energy of the Saxons, whose work the Norman, with his passion for the chase, undid so ruthlessly.

This description of the physical aspect of our island applies still more to the Neolithic age, when no Aryan husbandman had yet struck his plough into the soil, or burned the timber into charcoal for the smelting of the abundant ore. The earliest known Neolithic settlers in Britain were a short and thickset people, with long or oval heads, dark hair, probably swarthy complexions, aquiline noses, long narrow foreheads, and with the tibia or shinbone presenting in many cases that flattened, sabre-like form, called platycnemia—a feature not so much indicative of ape-like ancestry as of physical change due to the freer and more constant use of certain muscles which are brought into action in hunting game on foot, and such-like occupations. These people, the Kynesii, of whom Herodotus speaks as dwelling outside the Pillars of Hercules, furthest away towards the setting of the sun, are now generally identified with the remnants of non-Aryans known to us as Iberians, found in various parts of Europe, descendants of the wide-spread race whose relics—tombs, and stone circles marking the transition from burial-place to temple—exist by thousands in both hemispheres. Notable among these remnants are the Basques, living in the Western Pyrenees, and speaking a relatively modern language which is the sole survivor of the Iberian family of speech, and, so far as is known, without affinity with any other language in the world. But it is obvious that unless the untenable and indolent theories

* Published by S.P.C.K. London. 1882.
† London: B. Quaritch. 1882.

of some historians respecting the universal extermination of subject races in these islands be accepted, some traces of such a folk are not to be confined to the Basque district, and in proof of this we have indications of their presence nearer home. There are in many parts of Ireland, of the Highlands of Scotland, and the Western Isles, traces by no means infrequent of a short, black-haired, long-headed stock, described as having a strange foreign look, of whom the late Mr. Campbell of Islay, in his remarkable collection of tales gathered orally in the West Highlands, gives a typical example. He says, "Behind the fire sat a girl with one of those strange foreign faces which are occasionally to be seen in the Western Isles—a face which reminded me of the Nineveh sculptures and of faces seen in St. Sebastian. Her hair was as black as night, and her clear dark eyes glittered through the peat smoke. Her complexion was dark, and her features so unlike those who sat about her that I asked if she were a native of the island, and learned that she was a Highland girl." * Neither is the swarthy type absent from England and Wales, not only in ancient Siluria (comprising Glamorganshire, Brecknock, Monmouth, &c.), but in some parts of East Anglia, also in the south-west, and even in the Midland Counties, in which last, with their traces of the predominant influence of the Saxon and Danish conquerors, we might expect to find only a fair-haired and light-complexioned folk. "When we consider the many invasions of strangers, and the oscillations to and fro of different peoples, it is impossible not to realise the strange persistence of the race. Through all the troubles which followed the conquest of Gaul by Cæsar, and of Britain by Claudius, through all the terrible events which accompanied the downfall of the Roman Empire, causing the Britons to be exterminated over a large part of England, and the almost total extinction of the ancient type of Roman in Italy, the Iberian lived, and still is found in his ancient seats, with physique scarcely altered, and offering a strong contrast to the fair-haired Celtic, Belgic, and German invaders. The Iberian race is known to the ethnologist and historian merely in fragments, sundered from each other by many invasions and settlements of the Aryan race. It is shown by the researches into caves and tombs to have been in possession of the whole of Europe north and west of the Rhine in the Neolithic age, and has been traced by Dr. Virchow into Germany and Denmark." † Next in succession to it is the Celtic immigration, the invasion of Britain by tall, round-headed, fair-haired, large-limbed men, bringing with them a mighty motor power in human progress in their knowledge of the use of the metal bronze which they had acquired along the route. These Celts were divided into two groups, the one, and the earliest to cross the sea and repeat the conquest of Gaul in the conquest of Britain, being the Gaidhelic or Gaelic, formerly written by themselves Goidel. From this branch, the Goidelic, are descended the people in Ireland, the Isle of Man, and the Northern Highlands, who speak Gaelic. The second group, the Brythonic, from Brython, the Welsh form of Briton, are the ancestors of the Welsh people and the Britons, the ancient Gauls being also included with them, since the Brythons were Gauls who came over to settle here. To one of these two branches every Celt belongs.

The remains of these Celtic and of the pre-Celtic peoples indicate what befell the latter. The round barrows of the wolds of Yorkshire contain about an equal proportion of the skeletons of long-shaped and round-shaped skulls, pointing to intermarriage and generally friendly relations between the two; but in the southern parts of the island the round-headed type is dominant, pointing to the expulsion of the pre-Celtic.

(*To be concluded.*)

* "Tales of the West Highlands," iii. 144.

† Boyd Dawkins's "Early Man in Britain," p. 331.

Reviews.

Emin Pasha in Central Africa. Being a Collection of his Letters and Journals. Translated by Mrs. R. W. FELKIN. (Geo. Philip & Sons.)—Pending the arrival of Stanley's relief expedition the world is longing to know all it can about the brave and unselfish Emin, and his friends have exercised a wise discretion in publishing the letters and extracts from journals which he has sent to various correspondents during the past ten years. To future generations, when time shall have given its truer proportion to events which are yet too near us for right focus, there will, we think, be no more striking and dramatic figures of our day than Gordon at Khartûm and his trusted friend Emin, who happily survives to maintain firm and bloodless rule in Central Africa, protecting his people from the slave-hunter, and refusing to desert them at the prospect of approaching relief. In the last letter which this book gives, dated Wadelai, April 17, 1887, he tells Dr. Felkin that he will not leave his post. "If the people in Great Britain think that as soon as Stanley or Thomson comes I shall return with them, they greatly err. I have passed twelve years of my life here, and would it be right of me to desert my post as soon as the opening for escape presented itself? For twelve long years I have striven and toiled, and sown the seeds for future harvests, laid down the foundation-stones for future buildings. Shall I now give up the work because a way may soon open to the coast? Never . . . All we would ask England to do is to bring about a better understanding with Ugánda, and to provide us with a free and safe way to the coast. This is all we want. Evacuate our territory? Certainly not!"* And this is the man to whom our late poltroon Government permitted the Egyptian Government to "give the sack," to put it plainly, in the early part of 1886. "It is," Emin says, "a cool business despatch in the fullest sense of the term, not acknowledging by a single word the cares I have borne for three years, my fights with Dangola and negroes, my hunger and nakedness, not giving me a word of encouragement in the superhuman task of leading home the soldiers, which now lies before me. However, I am accustomed to this sort of thing. In the years 1878–80, during which the river was blocked for twenty-two months, I held the country and people together, and showed for the first time that we could maintain ourselves by our own strength without any supplies from Khartûm, and not only did I spare the Government expense at this time, but also proved practically that the province could, under an honest administration, yield a surplus. . . . Yet, who has given me even a word?" Emin, "the Faithful" (faith justified by works, in this case) is the Turkish name which, to smooth his intercourse with the Mohammedans, was adopted by Eduard Schnitzer, who was born in 1840 at Oppeln in Silesia. He became a student of medicine, and his passion for travel and love of natural history carried him to Turkey, where he procured an appointment on the staff of the Vali of Asia Minor, and ultimately entered the Egyptian service, being sent to Khartûm, and thence, as the chief medical officer of the Equatorial province, of which

* Since this notice was written, a letter appears in the *Times* of April 10, under date Wadelai, August 16, 1887, from Emin Pasha, expressing the same firm resolve.

Gordon was governor. The two men became fast friends; and when Gordon was appointed Governor-General of the Soudan he promoted Emin as governor of the Equatorial province, which extends from nine degrees to two degrees north of the equator. A clear and indispensable map, which Mr. Ravenstein has engraved for this volume, enables the reader to follow with ease the various journeys described. It is the record of these visits to the different parts of his province that the letters and journals mainly embody, and they supply a vivid and interesting narrative of the incessant and varied work which Emin has carried on in the face of stupendous difficulty, danger, and discouragement. While engaged in raising and drilling troops, substituting native for Egyptian soldiers, promoting trade, encouraging cultivation of coffee, indigo, cotton, and other products, adding large districts to his territory, not by war, but by skilful negotiation, converting a deficit of over 30,000*l.* into a surplus of 8,000*l.*, Emin has also found time to make extensive observations on the geology and general features of the province, to form large collections of its plants and animals, and to gather copious details concerning the manners, customs, and beliefs of its various tribes, notably of the Monbuttus, a cannibal, but, in many respects, advanced race, to whom he devotes a special section (pp. 186–213). Despite a good deal of inevitable repetition and of sameness in details, the letters and journals deserve to be read without skipping, a task the more easy because their translation has been so skilfully done by the wife of Emin's missionary friend, Dr. Felkin, that they read as smoothly as if the originals had been written in English.

Geology: Chemical, Physical, and Stratigraphical. By Joseph Prestwich, Professor of Geology in the University of Oxford. Vol. II. (Clarendon Press.)—This volume completes the important work into which the ripe results of fifty years' study of the science at which the Oxford professor has laboured *con amore* are gathered, and it is from cover to cover worthy of his high reputation. We notice that the publishers give prominence in the advertisements of this book to the advocacy of "the non-uniformitarian views of geology" by its distinguished author, but surely he can be no party to the sounding of this note of challenge, since his attitude is not that of the defiant extremist which that implies. The day is happily past when the scientist is sunk in the partisan, for the differences between contending schools are often found to be rather of terms than of principles. Because Lyell, after careful sifting of evidence, abandoned the old catastrophism and argued from the ascertained operations of existing causes, that the same causes, allowing for variation of degree, have sufficed to bring about past changes, a host of purblind followers have contended for an unalterable uniformitarianism. It is against such extreme applications of the doctrine that Professor Prestwich contends when he says that "while the laws of chemistry and physics are unchangeable, and as permanent as the material universe itself, the exhibition of the consequences of those laws in their operation on the earth has been, as new conditions and new combinations successively arose in the course of its long geological history, one of constant variation in degree and intensity of action."* Perhaps the word "constant" implies more than we are prepared to admit, but, as Professor Huxley remarked in his anniversary address to the Geological Society in 1869 on Geological Reform, "there appears to be no sort of necessary theoretical antagonism between Catastrophism and Uniformitarianism. On the contrary, it is very conceivable that catastrophes may be part and parcel of uniformity." And he illustrates his meaning by the working of a clock, the good time-keeping of which means uniformity of action. "But the striking of the clock is essentially a catastrophe; the hammer might be made to blow up a barrel of gunpowder or turn a deluge of water; and, by proper arrangement, the clock, instead of marking the hours, might strike at all sorts of irregular periods, never twice alike, in the intervals, force, or number of its blows. Nevertheless, all these irregular, and apparently lawless, catastrophes would be the result of an absolutely uniformitarian action, and we might have two schools of clock theorists, one studying the hammer, and the other the pendulum." In his first volume Professor Prestwich dealt with the nature and distribution of the materials forming the crust of the earth, and with the several agencies by which, in the remodelling of those materials, the stratified have been developed from the unstratified rocks. The present volume treats of the original condition of that crust, of its anatomy, history, and organic contents, and concludes with a discussion of those abstract physical and cosmical problems which relate to the evolution of the globe and of the system to which it belongs. The distinctive feature of the author's treatment of the stratigraphical branch of his subject is in his insistance on the impossibility of any universal scheme of classification, the formations in distant areas being correlated not by identity of species, but by the presence of the same characteristic genera, the large community of which amongst the Invertebrata everywhere is most striking. He remarks that "the great time-divisions are of almost universal application, but the smaller 'breaks in continuity,' which are of frequent occurrence in all areas, are subject to constant differences of extent and value; consequently, in filling up the details of the several geographical areas, each one is found to have its own local stamp, and possess its own special terms, some knowledge of which is as essential to the geologist as is the language of a country to the traveller, if he would pass through it with profit" (p. 3). As novel and informing commentary on this, we have several tables of classification showing the equivalent strata in various parts of Europe, and in America, Asia, Africa, and Australasia, with brief "lists of the characteristic genera of plants and animals attached for the purpose of showing the distribution of some of the more important life-forms over the globe at the several contemporaneous epochs." Altogether, the space given to the geology of other countries is a unique and valuable feature of the volume. Convenient summaries of the faunas and floras of each period are supplied, so that a great mass of facts is helpfully grouped for easier grasp by the student, for whom also an abundance of excellent plates and woodcuts, together with a geological map of Europe, are provided. In the chapter on the Quaternary or Pleistocene period, to our knowledge of which the author's researches have largely added, some remarks on the place of man in the geological record are included, and it is significant of a turn in the tide to find Professor Prestwich admitting the probability of man's existence in North-Western Europe in the glacial epoch, the duration of which he thinks may not have been longer than from 15,000 to 25,000 years. This is in keeping with the generally shorter estimates of time than are usually demanded by geologists which characterise the volume, and so far paves the way for reconciliation between geologists and physicists.

Chambers's Encyclopædia. Vol. I., A to Beaufort. (W. & R. Chambers. 1888.)—The publishers remind us in their preface that their great work has been before the world in complete form for twenty years. Revision has gone on at frequent intervals, but the time has arrived for an entire recast of the matter, involving the rewriting of a large proportion, so as to bring down the information to date. So far the work has been well and thoroughly done;

* Vol. i. p. vi.

and never did an undertaking more nobly redeem the promise of its preface than this first volume of the new edition, which, for the convenience of the many, is also under issue in monthly parts. Even to the few who can afford to buy the bulky "Encyclopædia Britannica" this moderate-sized and cheap companion is as indispensable as the "finder" to a big telescope. Not relying solely on authorities whose names might justify our taking their contributions on trust, we have gone over the majority of the articles with considerable care, and the result warrants the highest praise that we can give. Mr. Grant Allen's article on Anthropology is a masterly and lucid survey of the science; the cognate articles on Animism, Animal- and Ancestor-Worship are models of brevity and clearness, while including material for the reader to form his own judgment on Herbert Spencer's and opposing theories; the article Ballad, by the same skilful hand, has had the advantage of revision by Andrew Lang and others. Professor Tait's article on the Atom supplies, *inter alia*, an untechnical account of the periodic law of the elements; the article on Matthew Arnold —now, we must sorrowfully add, gone to his rest— seizes in a few words the characteristics of his work both in prose and verse; while among the contributions from the United States, the insertion of which happily protects the work from Transatlantic thieves, we must single out as especially complete and interesting Dr. Greene's article on the American Indians. *Per contra*, under Animal, the writer, in speaking of the presence of chlorophyll in certain infusorians and other invertebrates, overlooks Sach's explanation that it is not a proper constituent of their bodies, but due to the presence of vegetable cells which they assimilate; under archæology, Dr. Anderson has not sufficiently insisted on the totally unlike conditions and characters of the Palæolithic and succeeding ages; the discovery of a deep sea Ascidian (*Octanemus Bythius*) by the *Challenger* expedition might have been noted in the article under that heading, and the article on the Aryans will soon need considerable revision. To descend to trifling errors, "Robert Maitland" should be "Thomas Maitland" in the article on Anonymous. We should add that the maps, which are both political and physical, and also the woodcuts, are very superior to those given in the old editions, and that the typography is perfect.

Marahuna: a Romance. By H. B. MARRIOTT WATSON. (Longmans.)—We think this story marks the approaching exhaustion of the modern romantic school, to which Hugh Conway's and Rider Haggard's tales gave chief impetus. It was an inevitable reaction from the colourless, analytical, white-of-egg flavoured studies of Howell and James, making any change of diet welcome to the confirmed novel-reader. Not that this book lacks an original side, but that the combinations are limited and the surprises discounted. The talk on shipboard is too "high-falutin'," and Marahuna herself inspires languid interest, the only quality in her which gives force to the character is akin to that which Grant Allen presents so powerfully in "For Maimie's Sake." The scenes of the story alternate between the Antarctic circle and Hampshire; the origin and fate of Marahuna our readers mu·t learn from the book itself.

Civilisation and Progress. By JOHN BEATTIE CROZIER. New edition. (London: Longmans & Co. 1888.)—No one can rise from the perusal of the work whose title heads this notice without the conviction that its author has established a claim to stand high among the most profound and original thinkers of the day. He has set himself an ambitious task, and he has very narrowly indeed escaped entire success. In his search for a consistent theory of civilisation and progress, Mr. Crozier successively discards the historical, the metaphysical, and the psychological methods, and founds his own new organon on "the laws of the human mind in its entirety as a concrete unity"—an elastic definition which crops up, as a *deus ex machinâ*, throughout the work. That such laws are immutable is taken for granted. Portions of the work before us must irresistibly attract the reader. We may instance chapter vii. of Part. I. and the whole of Part IV. among them. But the man who sets himself to frame a new method for the investigation of the factors and causes operative in the advancement of the human race should above all things be impartial, and this our author assuredly is not. His unreasoning admiration of democracy in the abstract to a large extent blinds him entirely to its operation in the concrete. Certainly his picture of America is evolved from the depths of his own moral consciousness. Everyone personally familiar with the United States knows that politics there are practically abandoned to the scum and dregs of the population, and that an American *gentleman* (and there is an upper class even in Mr. Crozier's model Republic) repudiates with scorn and loathing the slightest sympathy or fellowship with the caucus-mongers, log-rollers, and wire-pullers who dominate all political matters whatsoever there. A great many hard things have been written and said about the Corporation of the City of London, but Mr. Bottomley Firth himself would scarcely dare to insinuate the possibility that the Lord Mayor and Aldermen could ever be guilty of the infamous corruption and peculation of which the municipal authorities of New York were convicted at a comparatively recent date. As for current French Republicanism, no further reference is needed to it here. When evolution shall have developed a superior type of the human race, Mr. Crozier's supposititious Republic may become an accomplished fact: at present "the laws of the human mind," as known to us in their outward manifestations, present an insuperable bar to the realisation of his Utopian dream. The constitution of a country may confer political equality upon every one of its citizens; but to suppose that they can or ever will become socially equal is as reasonable as to imagine that their height or the colour of their eyes can be regulated by a statute. *Malgré* the small display of fanaticism which has elicited these remarks, the author of "Civilisation and Progress" has produced a work of very high merit, and one which will repay perusal and reperusal.

The English in the West Indies; or, the Bow of Ulysses. By J. A. FROUDE. (Longmans.)—In the present work Mr. Froude gives us the result of his acquaintance with a very different batch of colonies from those which formed the subject of his brilliant sketches in "Oceana." If it lacks the freshness and vigour of that book, drawn as these qualities were from the material dealt with, it has a more romantic flavour, mixed with bitterness at the neglect which has allowed whilom bright jewels in the possession of the Crown to become dull and tarnished, or, as the author in repeated metaphor says, the bow of Ulysses to remain unstrung. In his own matchless prose Mr. Froude tells how the Caribbean Sea, from Trinidad to Jamaica, was the cradle of our naval empire, the scene of exploits to furnish the most stirring cantos if ever England's victories on the seas are done into an epic poem. All the romance of adventure and conquest in the New World defiles before us; every hero, from Columbus to Drake and Rodney, is there, "the captains of the ships and all the ships in order." But the main subject of the book is the West Indies of to-day, with the problems of England's position towards the decreasing white and the increasing black populations, which our party leaders, miscalled statesmen, ignoring inherent differences in the capacity and power of self-

XUM

control of races of mankind, have aggravated by their exportation of parodies of the mother institutions—household suffrage, representative assemblies, and so forth. They have ignored the fact that the personal relations between master and servant have ceased to exist with the abolition of slavery, and that the political elevation of the negro has done, and can do, nothing to establish new relations. We must confess that Mr. Froude, although paradoxical as ever, makes out a strong case for the government of those islands as Crown colonies. No tinkering with their political constitution can arrest the decay of their staple industry—sugar; capital and enterprise can only be tempted to remain in Jamaica, Dominica, and other suffering islands, or be attracted thither anew and be engaged in remunerative channels, by the firm rule of white over black. Let the superior race withdraw, and the negro populations will relapse into barbarism, with its revolting superstitions, cannibalism, devil-worship, &c., as they have in Hayti. We have said enough to indicate that, as a contribution to the mode in which the mother-country is to discharge her duty to these neglected, but lovely and fertile, islands of the West Indies, Mr. Froude's book demands serious perusal.

Juvenal in Piccadilly. By Oxoniensis. (Vizetelly & Co.)—Satires seem almost anachronisms nowadays. Since Alfred Austin published his "Season" we do not remember one that has appeared to lash the humours and follies of the town until the present brochure, which, free from the exaggerated tones of the great Romau, finds material for its crisp and brightly-written verse in vices and affectations which have changed their zone but not their nature.

Messrs. Blackwood & Sons send us a new and almost entirely rewritten edition of the late Professor David Page's *Introductory Text-Book of Geology*, the merits of which need "no bush" from us; from Messrs. Smith & Elder we have Volume XIV. of their noble *Dictionary of National Biography*, comprising Damon to D'Eyncourt, and therefore including the famous name of Darwin, the article on whom is fitly from the pen of his son and biographer; amongst current serials we have to acknowledge the *Westminster Review*, containing a delightfully fresh paper on Heine; the *Century*, the *Cyclopædia of Education*, *Longmans*, in which appears Mr. Besant's important paper on making provision for girls; and *Baby, an Illustrated Magazine for Mothers*, which, we hope, will be received by them as its prospectus says it has been received by the press—"with open arms."

The author of *Sunlight* (reviewed on p. 140) complains that we represent him as explaining gravitation by the action of light, whereas he only stated that light "developed" gravitation. He further objects to a quotation from his volume anent meteorites being earthy atoms separated from the air by cold pressure and vegetation. What he meant was that by "the death and decomposition of Fauna and Flora their dusts do rise, and may become constituents of meteorites when separated from the air by cold pressure" (!). We trust that our readers will appreciate the value of these corrections, and judge how far they affect the validity of our original judgment on the book in connection with which we have been asked to make them.

Our Whist Column.

By "Five of Clubs."

MAKING THAT LITTLE TRUMP.

THE other evening two Bumblepuppists, playing as partners against two sound but not specially brilliant players, distinguished themselves in the following triumphant manner:—

THE HANDS.

B { C. (*trumps*).—K, Kn, 6. H.—A, 6, 5, 2. / D.—Q, 10. S.—A, Q, 9, 6. }

Y { C. (*tps*).—9, 8, 7, 4. / D.—K, 8, 6, 2. / S.—K, 5. / H.—K, 4, 3. }

B

Y Z

Tr. C. 10

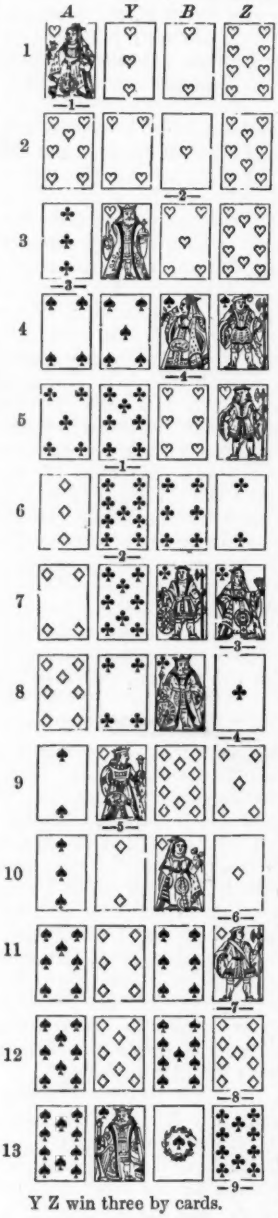
A leads.

Z { C. (*tps*).—A, Q, 10, 2. / D.—A, Kn, 9, 5. / S.—Kn. / H.—Kn, 10, 9, 8. }

A { C. (*trumps*).—5, 3. H.—Q, 7. / D.—7, 4, 3. S.—10, 8, 7, 4, 3, 2. }

Score:—A B love; Y Z 2.

Card underlined wins trick; card underneath leads next.



Y Z win three by cards.

NOTES.

1. A sees no other chance of making a trick or two from his own hand but by ruffing Hearts. He therefore leads the Queen. Y follows the system now generally approved, and does not put an honour on an honour. Z begins a signal, hardly justified with one suit so weak; but the double tenace in trumps makes it desirable that Z should not himself have to lead trumps. Moreover, Z knows from his own Hearts that A has led from weakness, with a probable view to ruffing.

2 and 3. A's lead could hardly have better served his purpose if he had had the arranging of the Hearts in the other hands. The little trump is not only made, but it kills the Heart King.

4. A now opens his long suit, after getting rid of the one card which would have given him any chance of re-entering if (as is by no means unlikely) the suit is quickly established.

5. Of course B should have forced Z's strong trump hand with the Spade Ace. But B has not noticed the signal; and if he had, he would not have known what to do about it. What his reason was for leading Hearts when he must have known that he was giving Z the tenace by so doing, it would be difficult to say. (That is the worst of weak players; one can seldom imagine their reason even when they have one, but they generally have none.)

6, 7, and 8. Of course Y leads his best trump, and Z, knowing A's weakness, passes the Nine. B is again led through, and Z then draws the trump King.

9, 10, &c. The rest of the game plays itself.

As Z threw down his last three cards, all winning ones, A remarked to B, "Lucky I played as I did!" To which B responded, "Yes, we got two tricks by it, though we were too weak to save the game; isn't that so?" turning to Z. "Hardly," said Z, "you not only did not make two tricks you would otherwise have lost, but you lost one trick at least you would otherwise have made; so that your play really lost you the game and the rubber. This neither A nor B would believe, till Y Z rearranged the cards, and, placing them face upwards on the table, showed that sound play (independently, of course, of any know-

ledge already obtained about the cards) would have given the following result:—

A	*Y*	*B*	*Z*		*A*	*Y*	*B*	*Z*
1.—S 4	S 5	S Q	S Kn		8.—D 3	D K	D 10	D 5
		—1—				—5—		
2.—S 2	S K	S A	C 2		9.—D 4	D 6	C 6	D 9
			—1—				—4—	
3.—H Q	H K	H A	H Kn		10.—S 3	D 8	S 6	C 10
		—2—						—6—
4.—H 7	H 3	H 2	H 8		11.—S 7	C 8	C Kn	D Kn
			—2—				—5—	
5.—C 3	H 4	H 6	H 10		12.—S 8	C 4	S 9	C Q
—3—								—7—
6.—D 7	D 2	D Q	D A		13.—S 9	C 9	C K	C A
			—3—					—8—
7.—C 5	C 7	H 5	H 9					
	—4—							

Y Z make only two by cards. As it chanced, the treble made by Y Z completed a rubber, so that the extra point which A B's bad play gave Y Z made a considerable difference in the score for the evening

Our Chess Column.

By "MEPHISTO."

SOME time back, at the Divan, Mr. Blackburne was made the victim of the severe criticisms and strictures of one of those professors of "the art of problem construction," who make problems, solve problems, and judge problems according to strict rules and canons. Herr Spitzler is not satisfied with a mere effort of the imagination conceiving a pretty idea and shaping it into problem form; he has æsthetic notions about "beauty of construction," "economy of force," "difficulty," "originality," "purity," "harmony," &c., and unless a composition can stand all these tests, the Professor does not think much of it. Accordingly, when Mr. Blackburne, speaking of his own powers of blindfold play, showed some end-games which he brought to a happy termination *sans voir*, though playing eight games at the same time, one or two simple individuals expressed their surprise at such brilliant performances. Not so, however, the Professor, for, said he, "Speaking of end-games generally as played by great players, I do not think there is any cause for great admiration. In most instances a mate is accomplished by brute force, and though a piece or two may be sacrificed, yet the object is the same—to force mate in a few moves by a most direct method, check, check, check, and mate Compared with a fine problem," he said, "the best end-game played is but a clumsy and raw production. I have never yet seen a mate forced in an end-game by a quiet and non-threatening move, which makes problems so beautiful."

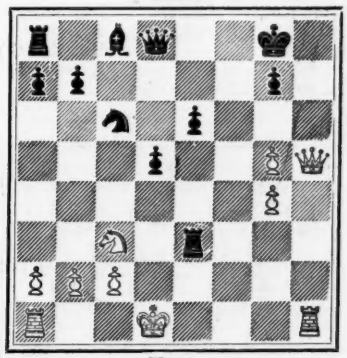
"Well," said a well-known chess editor, "I think I can show that Professor Spitzler is wrong in his basis of comparison between end-games and problems, and his consequent strictures. For the sake of comparison, let me ask you whom would you think the greater general, the commander who wins an actual battle in the field by rough though clever and bold manœuvres; or the staff officer who, in imitation of this event, works out a scheme which he puts into execution on the parade ground, when, as a result of a sham fight, both armies being like clay in his hands, he wins a battle with greater 'brilliance,' 'economy of force,' 'difficulty,' 'harmony,' and 'purity of manœuvring'?" And as for the assertion that the quiet move is never found in practical end-play, I can contradict that by a game just received by the American mail, which was played only last month by Steinitz at Havanna. Here it is:—

1. P to K4	1. P to K3
2. P to Q4	2. P to Q4
3. QKt to B3	3. KKt to B3
4. P to K5	4. KKt to Q2
5. P to B4	5. P to QB4
6. P × P	6. B × P
7. Kt to B3	7. Castles
8. B to Q3	8. QKt to B3
9. P to KR4	9. P to B3
10. Kt to KKt5 !	

To bring about an end-game by such means in actual play is a different thing from making a problem.

10.	10. P × Kt
11. B × P (ch) !	11. K × B
12. P × P (disc ch)	12. K to Ktsq
13. Q to B5	13. Kt(Q2) × P
14. P × Kt	14. R to B4
15. P to KKt4	15. R × KP(ch)
16. K to Qsq	16. B to K6
17. B × B	17. R × B

YOLMAYO.
BLACK.



WHITE.
STEINITZ.

Now the Professor was challenged to find the decisive move, but in spite of numerous and prolonged attempts, he failed to do so, which only proves, said the editor, that you were wrong in saying that winning moves in actual end-games are more or less obvious, because forcible, and never quiet. Steinitz now played the very quiet move of 18. Kt to Kt5, which is decisive, and equal to any similar move in a problem, but infinitely more meritorious. The object of this move is to cut off the retreat of the King. White threatens P to Kt6. Black cannot play his Kt to K4, for he loses the Queen by Q to R8 (ch), nor can he play K to Bsq on account of R to Bsq (ch). Or if P to K4. 9. Q to R7 (ch) K to B2. 20 R to Bsq (ch), K to Ksq. 21. Q to Kt6 (ch), K to Q2. 22. Q to Q6 (ch), K to Ksq. 23. R mates. Black actually played

18. 18. R to B6

19. P to Kt6, and Black resigned.

The Professor, although admiring the move of 18. Kt to Kt5, did not appear convinced on the whole, and promised to write an elaborate treatise on the comparative merits of problems and actual end-games.

Game played in the Handicap Tournament, played last month at Simpson's Divan.

WHITE. J. Gunsberg.	BLACK. J. H. Zukertort.
1. P to K4	1. P to K4
2. QKt to B3	2. KKt to B3
3. Kt to B3	3. Kt to B3
4. P to QR3	4. P to Q4
5. B to Kt5	5. P to Q5
6. Kt to Kt2	6. B to Q2

If Kt × P, then probably 7. P to Q3, Kt to Q3; 8. B × Kt (ch), P × B; 9. Kt × KP.

7. P to Q3	7. B to Q3
8. Kt to Kt3	8. Kt to K2
9. B to QB4	9. P to KR3
10. Castles	10. P to KKt4

White threatened to break up Black's position by Kt × KP.

11. P to B3 !	11. P × P
12. P to Q4	12. Kt to Kt3
13. KtP × P	13. Castles
14. Kt to B5 !	14. Kt × P

If K to B2. 15. B × KtP, P × B. 16. Kt × P (ch), followed by Kt × P, with a winning advantage. Of course 14. B × Kt. 15. P × B followed by 16. P × P.

15. Kt × P (ch)	15. K to Kt2
16. P × P	16. B to K2
17. Kt × BP	17. Kt × QBP
18. Q to B2	18. R × Kt
19. B × R	19. K × B
20. Q × Kt	20. P to Kt5
21. R to Qsq	21. P × Kt
22. P to K6 (ch)	22. K × P
23. Q to Kt3 (ch)	23. K to B3
24. B to Kt2 (ch)	24. K to Kt4
25. Q to K3 (ch)	25. Kt to B5
26. R to Q5 (ch)	Resigns

The following instructive ending occurred in a game played in the Divan Tournament between Messrs. Zukertort and Muller; the former player in this position moved his K to Kt6, R to R7, and the

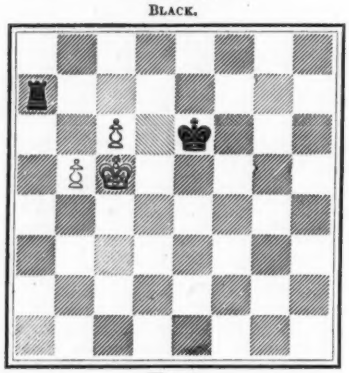
XUM

game resulted in a draw. Mr. Blackburne subsequently pointed out that White could have won by playing

P to Kt6,	for if	R to R4(ch)
K to Kt4,	then,	R to R8
P to Kt 7		R to Kt8(ch)
K to B5		R to B8(ch)

K to Q4, and White wins

MULLER.
BLACK.



WHITE.
ZUKERTORT.

THE FACE OF THE SKY FOR MAY.

By F.R.A.S.

SPOTS on the sun are both small and very infrequent, but his disc may be watched on clear days. The night sky is depicted on map v. of "The Stars in their Seasons." Mercury is a morning star at the beginning of May, coming into superior conjunction with the sun on the 10th. Then of course he travels to the east of the sun and becomes an evening star. At the end of the month he may be caught with the naked eye after sunset, over the N.W. by W. part of the horizon. Venus is a morning star, but her appearance is singularly insignificant when compared with that which she presented last November, when so many fatuous people hailed her as "the star of Bethlehem." Mars is still a striking object in the night sky, but his angular diameter is steadily and sensibly decreasing. It will be noted, too, by the sharpsighted observer with the telescope that he is no longer quite round. He will be found between θ and γ Virginis ("The Stars in their Seasons," map v.). On the night of the 5th he and Uranus will be so close together as to be in the same low-power field of a telescope. Jupiter is visible near to midnight, in fact sooner, but is so very low down that to be seen in the least degree favourably he should be looked at when close to the meridian. Jupiter is travelling towards β^1 Scorpii ("The Stars in their Seasons," map vii.), and will, in fact, be only 2′ north of that star during the early morning of the 21st. The phenomena of his satellites fairly observable at convenient hours during May are as follow. On the 1st the ingress of the shadow of satellite i. will happen at 11h. 43m. P.M., and that of the satellite itself twelve minutes after midnight. On the 2nd satellite i. will reappear from occultation at 11h. 42m. P.M. On the 5th satellite ii. will disappear in eclipse at 11h. 43m. 33s. P.M. On the 6th satellite iii. will suffer eclipse at 11h. 26m. 14s. P.M. On the 7th satellite ii. will pass off Jupiter's face at 9h. 58m. P.M. On the 9th satellite i. will disappear in eclipse at 10h. 59m. 13s. P.M. On the 10th the shadow of satellite i. will leave the planet's disc at 10h. 17m. P.M., followed by the satellite casting it at 10h. 33m. P.M. On the 14th satellite ii. will begin its transit across Jupiter at 9h. 46m. P.M.; its shadow will pass off at 11h. 53m, as will the satellite itself 12 minutes after midnight. On the 16th satellite i. will be eclipsed at 12h. 53m. 8s. P.M. On the 17th the shadow of satellite i. will begin its transit at 9h. 59m. P.M., as will the satellite itself at 10h. 6m. The shadow will leave Jupiter's opposite limb at 12h. 12m. P.M., and the satellite at 12h. 17m. On the 18th satellite i. will reappear from occultation at 9h. 36m. P.M. On the 21st the shadow of satellite ii. will enter on to Jupiter's limb at 11h. 58m., followed 2 minutes later by the satellite casting it. On the 24th the shadow of satellite iii. will begin its transit at 9h. 1m. P.M., the satellite itself leaving the opposite limb at 10h. 29m. P.M., and the shadow at 10h. 56m. Then, at 11h. 50m., the transit of satellite i. will begin, followed by that of its shadow at 11h. 53m. P.M. On the 25th satellite i. will be occulted at 9h. 8m. P.M., reappearing from eclipse at 11h. 23m. 37s. On the 30th, satellite ii. will reappear from eclipse at 11h. 12m. 11s. P.M. Finally, on the 31st satellite iii. will begin its transit at 12h. 12m., and its shadow follow it at 12h. 59m. P.M. Saturn is rapidly approaching the west, and must be looked for the moment it is sufficiently dark to be seen at all. He is in Cancer, to the west of the Præsepe ("The Stars in their Seasons," map iii.). Uranus should be looked for not much later than 10h. 30m. P.M. to be seen to the greatest advantage. He is in Virgo ("The Stars in their Seasons," map v.). We have spoken above of his conjunction with Mars on the night of the 5th. Neptune is absolutely invisible. The moon enters her last quarter at 11h. 47·1m. P.M. on May 2, and is new at 1h. 23·5m. A.M. on the 11th. She enters her first quarter at 11h. 5·1m. P.M. on the 18th, and is full at 1h. 40·1m. in the afternoon of the 25th. Four occultations of fixed stars by the moon will happen at fairly convenient hours during May. The first occurs on the 16th, when the 6th magnitude star d^1 Cancri will disappear at the moon's dark limb at 11h. 5m. P.M. at an angle of 74° from her vertex. It will reappear at her bright limb at 11h. 45m. P.M. at an angle from her vertex of 337°. On the 20th b Virginis, also a star of the 6th magnitude, will disappear at the dark limb at 12h. 57m. P.M. at an angle of 135° from the moon's vertex. It will not reappear until 1h. 44m. the next morning at the bright limb at a vertical angle of 254°. On the 24th η Libræ, a 6th magnitude star, will disappear at the dark limb of the moon at 10h. 52m. P.M. at an angle of 128° from her vertex, reappearing at her bright limb at 11h. 23m. P.M. at an angle from her vertex of 181°. Lastly, before the moon rises on the 27th, she will have occulted 31 Sagittarii, also a 6th magnitude star, with her bright limb. The star will reappear at her dark limb at 11h. 23m. P.M. at a vertical angle of 240°. When our notes begin the moon is in Sagittarius, but passes into Capricornus at 10 o'clock to-night ("The Seasons Pictured," plate xxi.). She takes precisely forty-eight hours to cross Capricornus, and at 10 P.M. on the 3rd emerges in Aquarius. She is travelling through Aquarius until 1h. A.M. on the 6th, when she enters Pisces ("The Seasons Pictured," plate xxii.). As she traverses Pisces, at 9 P.M. on the 6th she enters Cetus. It is not until 6h. 30m. A.M. on the 8th that she re-enters Pisces. At 5h. 30m. A.M. on the 9th she for the second time plunges into an outlier of Cetus, and when she finally quits this at 9h. P.M. on the 9th it is to come out in Aries. She remains in Aries until 1h. A.M. on the 11th, when she passes into Taurus ("The Seasons Pictured," plate xxiii.). As she journeys over Taurus, she arrives at 1h. A.M. on the 14th at the western edge of the northern prolongation of Orion. This she has crossed by noon, and come out in Gemini ("The Seasons Pictured," plate xxiv.). It takes her until 10h. A.M. on the 16th to cross Gemini, and at that hour she enters Cancer. She leaves Cancer for Leo at 1h. A.M. on the 18th. It is not until 4h. P.M. on the 20th that she passes from Leo to Virgo ("The Seasons Pictured," plate xxv.), and it is 4h. P.M. on the 23rd before she has completed her passage through the last-named great constellation and entered Libra ("The Seasons Pictured," plate xxvi.). Traversing Libra, she arrives at 7h. A.M. on the 25th on the confines of the narrow northern spike of Scorpio, having crossed which she, at 2h. 30m., emerges in Ophiuchus. Here she remains until 2h. A.M. on the 27th, when she enters Sagittarius. By 7h. A.M. on the 29th she has completed her passage over Sagittarius and entered Capricornus ("The Seasons Pictured," plate xxi.). Here she continues until 5h. A.M. on the 31st, when she crosses into Aquarius. She is still travelling through Aquarius at midnight on the 31st.

Contents of No. 30.

	PAGE
The Kinship of Men and Apes, &c. By Professor E. S. Morse	121
Weighing the Earth	123
Coal. By W. Mattieu Williams	125
Lifting Great Weights	127
Notes on Americanisms	129
The Stars of other Times	130
Evolution of Language. By Ada S. Ballin	132
Strange Whist Hand	133
Meteor Birth of the Universe	134
The American Trotting Horse	135
Oyster Protection	135
The Ancient History of the Maori	135
Royal Victoria Hall	136
Gossip. By Richard A. Proctor	137
Reviews	140
The Face of the Sky for April. By F.R.A.S.	142
Our Whist Column. By "Five of Clubs"	142
Our Chess Column. By "Mephisto"	143

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